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Volume 5, Number 3
June 1978-September 1978

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OIL POLLUTION REPORTS (formerly OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly compilation of abstracts of current oil pollution related literature, research projects, and conferences. Comprehensive coverage of terrestrial and aquatic oil pollution and its prevention and control is provided, with emphasis on the marine environment. The report contains (a) citations and summaries of 1975 to 1978 scientific and technical publications, and patents; (b) status and summaries of current research programs; and (c) information on current meetings. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01-0 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the U.S. Environmental Protection Agency.

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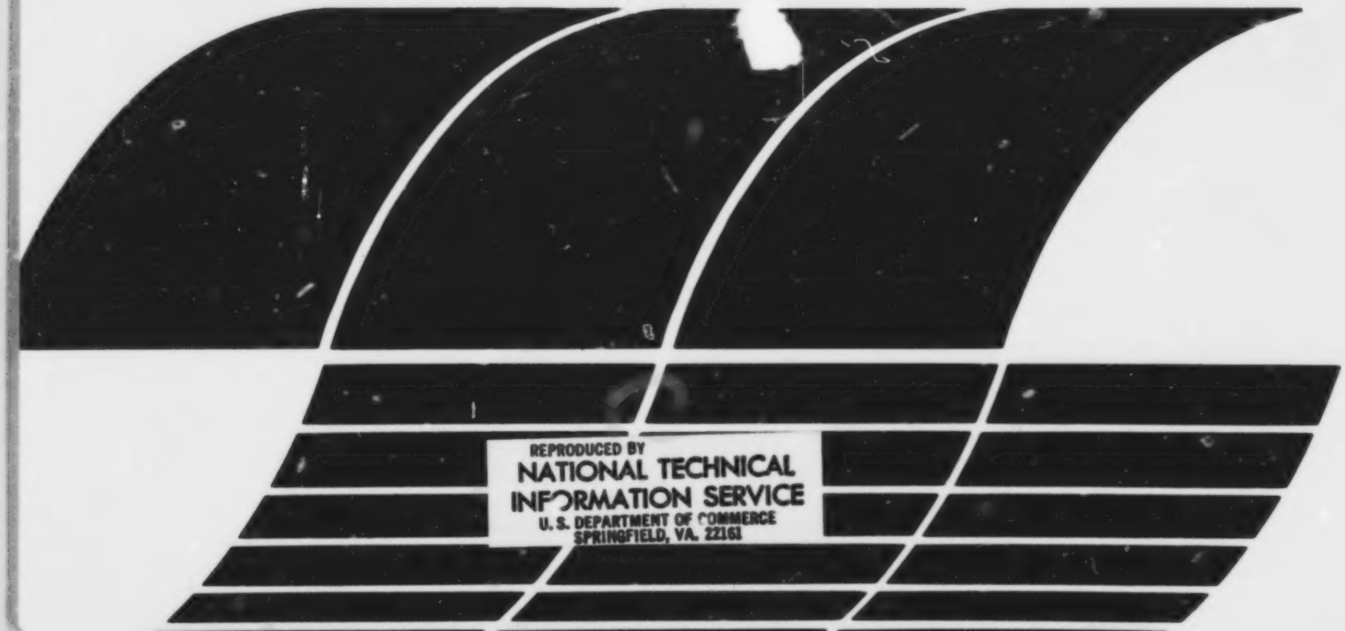

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1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy-Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the INTERAGENCY ENERGY-ENVIRONMENT RESEARCH AND DEVELOPMENT series. Reports in this series result from the effort funded under the 17-agency Federal Energy/Environment Research and Development Program. These studies relate to EPA's mission to protect the public health and welfare from adverse effects of pollutants associated with energy systems. The goal of the Program is to assure the rapid development of domestic energy supplies in an environmentally-compatible manner by providing the necessary environmental data and control technology. Investigations include analyses of the transport of energy-related pollutants and their health and ecological effects; assessments of, and development of, control technologies for energy systems; and integrated assessments of a wide range of energy-related environmental issues.

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EPA-600/7-78-218
November 1978

OIL POLLUTION REPORTS

Volume 5, Number 3
(June 1978 - September 1978)

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other materials relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci, to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL POLLUTION REPORTS (formerly entitled OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly compilation of abstracts of current oil pollution related literature, research projects, and meetings. Comprehensive coverage of terrestrial and aquatic oil pollution and its prevention and control is provided, with emphasis on the marine environment. The report contains (a) citations and summaries of 1975 to 1978 scientific and technical publications, and patents; (b) status and summaries of current research programs; and (c) information on current oil pollution related meetings. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01-0 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the US Environmental Protection Agency.

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The authors wish to thank the personnel of the Marine Science Institute, the Science Engineering Library, and the Interlibrary Loans office at the University of California, Santa Barbara, for their assistance during the research stages of this project. Special thanks go to Jonathan Smolen of the University of California, Santa Barbara, Computer Center, for his expert technical advice.

INTRODUCTION

OIL POLLUTION REPORTS (formerly OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly bulletin which reviews pertinent scientific and technical publications, research projects, and meetings, to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, and other literature relating to oil pollution published since 1975 (Section I); summaries and status of current research projects (Section II); and current oil pollution related conferences (Section III). This document series is now identified by volume and issue number; issues prior to 1978 were identified by quarterly dates alone, as shown on the following page.

Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. Items in Section I are categorized by eight major subdivisions which are divided into thirty-seven specific subject categories. A list of the periodicals reviewed in preparing this series appears in Appendix A.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications provided upon request by the principal investigators or performing organization. Notices of research projects are obtained primarily from the Smithsonian Science Information Exchange (SSIE). Entries are arranged according to the same subject categories as in Section I. Some of the projects listed in previous OIL POLLUTION REPORTS have been recently renewed. Those projects have been relisted with a current serial number, followed by the original number in parentheses.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following: C, reports, publications, and patents; and R, research projects. Keyword, author, and patent indexes are provided at the end of the report.

Section III, Current Conferences, contains descriptive information on recently held and upcoming meetings relevant to any aspect of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of oil pollution related papers are included. All information for this section was obtained from the periodicals reviewed (Appendix A) and from responses to written inquiries concerning the meetings.

OIL POLLUTION REPORTS
(Oil Spill and Oil Pollution Reports, 1974 to Vol. 5 No. 1)

Issues currently available, in press, or in preparation

	Dates Covered	Report Number
1974	July 74 - Oct. 74	EPA-670/2-75-003
1975	Nov. 74 - Feb. 75	EPA-670/2-75-044
	Feb. 75 - Apr. 75	EPA-670/2-75-059
	May 75 - July 75	EPA-600/2-76-129
	Aug. 75 - Oct. 75	EPA-600/2-76-113
1976	Nov. 75 - Jan. 76	EPA-600/2-76-185
	Feb. 76 - Apr. 76	EPA-600/2-76-215
	May 76 - July 76	EPA-600/2-76-266
	Aug. 76 - Oct. 76	EPA-600/2-77-037
1977	Nov. 76 - Jan. 77	EPA-600/2-77-075
	Feb. 77 - Apr. 77	EPA-600/2-77-111
	May 77 - July 77	EPA-600/2-77-243
	Aug. 77 - Oct. 77	EPA-600/2-78-005
Vol. 5 No. 1	Nov. 77 - Jan. 78	EPA-600/2-78-071
Vol. 5 No. 2	Feb. 78 - May 78	Submitted 6/78
Vol. 5 No. 3	June 78 - Sep. 78	Submitted 10/78
Vol. 5 No. 4	Oct. 78 - Dec. 78	To be prepared

For complete ordering information, please see Appendix B.

ABBREVIATIONS/ACRONYMS

atm	atmosphere
bbl	barrel
C	carbon
°C	degrees centigrade
cm	centimeter
COW	crude Oil Washing
DWP	deepwater port
dwt	dead weight ton
EIS	environmental impact statement
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GC	gas chromatography
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
in	inch
IR	infrared
kg	kilogram
km	kilometers
kn	knot
L	liter
lb	pound
LC	liquid chromatography
LD	lethal dose
LNG	liquefied natural gas
LOT	load on top
LPG	liquefied petroleum gas
m	meter
mg	milligram
mi	miles
min	minute
ml	milliliter
mm	millimeter
MS	mass spectrometry
N	nitrogen
O	oxygen
OCS	outer continental shelf
OPR	OIL POLLUTION REPORTS, formerly OIL SPILL AND OIL POLLUTION REPORTS
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pH	the negative log of the H ion concentration
ppb	part per billion
ppm	part per million
SBT	segregated ballast tank
sp.	species
TLC	thin-layer chromatography
UK	United Kingdom
US	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
vs	versus
WSF	water soluble fraction
wt	weight
yr	year
μ	micron
μg	microgram
%	percent
/	per

ABBREVIATIONS/ACRONYMS (continued)

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FOA	Food and Agricultural Organization
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USGS	United States Geological Survey
USN	United States Navy

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-0710-78
ADRIAN MAERSK SPILL AFTERMATH (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(5):115.

Compensation, Oil spills, Fish, Mortality, *Adrian Maersk spill, *Hong Kong

A damage settlement of 5 million dollars (Hong Kong) was distributed among the 138 fish farmers whose livelihood was destroyed by the oil spilled from the Adrian Maersk. The Danish-owned container ship lost 1000 tons of oil off Boulder Point, Lamma Island, Hong Kong, last September.

C-0711-78
AMOCO CADIZ: A LASTING DISASTER (news brief)
Anon. 1978.
Science News 114(6):85.

Biological effects, Amoco Cadiz spill, Acute effects, Marine organisms, Coasts, France

The article summarizes the preliminary findings of research teams investigating the acute and chronic effects of the Amoco Cadiz supertanker spill. The findings were contained in a joint NOAA-EPA report issued 4-1/2 months after the disaster. According to W. Hess, head of the NOAA research team, "we have never seen biological damage of this geographic extent in any previous oil spill." Much of the ecological damage occurred in marshes and tidal flats of the over 300 km of oiled shoreline.

C-0712-78
MEDITERRANEAN CLEAN-UP PENDING (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(3):61.

Oil spills, Pollution control, Contamination, Mediterranean Sea

Oceanographer Jacques Costeau, while attending the International Conference on Mediterranean Pollution, reported that the sea's main pollution contributers are oil spills and untreated sewage. The major long-term threat to the Mediterranean is contamination by toxic heavy metals and radioactive wastes. Cousteau advocated swift action and the expenditure of vast sums of money to combat land-based, industrial pollution sources.

C-0713-78
OIL PIPELINE SPILLAGES (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(1):3-4.

Pipelines, Leakage, Wastewaters, Refineries, *CONCAWE

Two reports by CONCAWE (the oil companies' international study group for conservation of clear air and water) are briefly reviewed. The 1976 report on spillages from cross-country oil pipelines in Western Europe shows that the total gross spillage in 1975 of 397 m^3 increased to 3165 m^3 in 1976, of which <400 m^3 was not recovered or safely disposed. A CONCAWE paper presented to a UNEP seminar in Paris on "Emissions and effluents from European refineries" concluded that they were not contributing "significantly" to Europe's surface water pollution. CONCAWE's address is Van Hogenhoucklaan 60, The Hague 2018, The Netherlands.

C-0714-78
OIL POLLUTION IN ARGENTINA
Anon. 1978.
Marine Pollution Bulletin 9(6):146-147.

Contamination, Environmental deterioration, Argentina

Reported are long-term oil pollution effects in the Patagonian region of southern Argentina. Bituminous oil residues have contaminated harbor installations at Comodoro Rivadavia, the main port, and obliterated all littoral marine life in these habitats. Little or no action is taken to control or clean up the pollution.

C-0715-78
OXYOIL FLOWS AT SCAPA (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(4):89.

Oil terminals, Birds, Statistics, North Sea, Scotland

A report of a talk by David Lea to the Orkney Field Club compares spill data from Occidental Oil's new North Sea oil terminal at Flotta with that of Milford Haven, the more heavily trafficked terminal. It was also reported that Longtailed Ducks and Black Guillemots feed and roost around Scapa Flow and mooring towers and buoys. 'Oxyoil' gives the polluted birds a distinctive cinnamon color.

C-0716-78
A SMELL IN THE NIGHT
Anon. 1978.
Ocean Reporter (April-May):11-14.

Amoco Cadiz spill, Environmental effects, France

An account is given of the circumstances surrounding the grounding of the Amoco Cadiz off the coast of Brittany on March 16, 1978.

C-0717-78
SPILLAGES FROM OIL INDUSTRY CROSS-COUNTRY PIPELINES IN WESTERN EUROPE (1976) (news brief)
Anon. 1978.
Water, Air, and Soil Pollution 9(2):249.

Pipelines, Petroleum products, Oil industry, Statistics, Europe, Oil spills

The 1976 statistics on spillages from cross-country pipelines are given in CONCAWE's annual report 9/77 (October 1977) and compared with figures from 1972-1975. The report may be obtained from CONCAWE, 60 Van Hogenhoucklaan, Den Haag, 2018, The Netherlands.

C-0718-78
CANADIAN ENVIRONMENTAL EMERGENCIES EVENT SUMMARY FOR 1977
Baker, B.E. 1978.
Spill Technology Newsletter 3(3):23-34.

Statistics, Oil spills, Petroleum products, Canada, *NATES database

Data on 1069 oil spills and 456 non-oil spills were extracted and summarized from the National Analysis of Trends in Emergencies System (NATES) database. The amount of petroleum products (16,229 tons) spilled in 1977 is the lowest reported since the database was initiated in 1974.

C-0719-78
OIL POLLUTION IN PEMBROKESHIRE
Bourne, W.R.P. 1978.
Marine Pollution Bulletin 9(3):59-60.

Oil terminals, Tankers, Oil spills, Oil slicks, Mortality, Birds, *Milford Haven

A series of oil pollution incidents near the giant oil terminal at Milford Haven in South Wales is reported. Court cases included the loss of 13 barrels of crude oil by the Liberian-registered tanker Aegean Captain, the appearance of an oil slick similar in composition to the oil from the Japanese tanker Choyo Maru, and the overflow of a ballast tank on the Greek tanker Messiniake Filia. Another oil slick in the vicinity caused considerable bird mortality at sea, including Guillemots, Manx Shearwaters, and Gannets.

C-0720-78
TANKER WRECKS AND THE HUMAN ELEMENT (editorial)
Clark, R.B. 1978.
Marine Pollution Bulletin 9(5):113.

Tankers, Statistical analysis, Argo Merchant spill

In the aftermath of the Argo Merchant spill, a report published by the Netherlands Maritime Institute on sub-standard tankers presents an illuminating analysis of tanker statistics for recent years. The report concludes that 75% of tanker pollution incidents are attributable to human operating errors. Accidents involving flags of convenience registered in Greece, Panama, Liberia, and Cyprus are proportionally far above the average.

C-0721-78
A REVIEW OF OIL POLLUTION INCIDENTS IN AND AROUND NEW ENGLAND
Hyland, J.L. 1977.
Report EPA/600/3-77/064. 43 p.

Oil spills, Statistics, USCG, *New England, *Review

A comprehensive review of the title topic is presented. The first section of the report categorically analyzes all oil discharge data compiled by the USCG during the years 1973-1975. Categories include where most spills occur, where the largest quantities are spilled, what types of oil are most frequently spilled and in what quantities, what the sources and causes are, and in what size range most spills occur. The second section summarizes spills within the last 25 years which have attracted public attention.

[from Government Reports Announcements 77(24):#PB-271 698/3GA. 1977]

C-0722-78
THE AMOCO CADIZ OIL SPILL - A PRELIMINARY ACCOUNT OF EVENTS
O'Sullivan, A.J. 1978.
Spill Technology Newsletter 3(3):28-34.

Amoco Cadiz spill, Beach cleanup, Environmental effects, Coasts, Marshes, Marine organisms, Fisheries, France

In late March 1978, the supertanker Amoco Cadiz lost its entire cargo of 220,000 tons of Arabian crude oil off the coast of Brittany, resulting in the largest oil spillage ever recorded. Onshore cleanup operations involved up to 6,500 persons at a time, and about 30,000 tons of the oil were recovered by the end of March. A preliminary survey of the environmental effects indicates that sheltered marshes and sandy shores have been the most severely affected, and that subtidal and intertidal macrofauna, including shellfish resources, have been heavily damaged.

C-0723-78
OIL POLLUTION ON THE COAST OF IRELAND
O'Sullivan, A.J. 1978.
Spill Technology Newsletter 3(3):15-20.

Statistics, Coasts, Ireland

Oil pollution of Ireland's coastline is tabulated and reported for the year 1976-1977, based on statistical data gathered from questionnaires submitted to government agencies, port and oil terminal authorities, and other relevant groups. On the whole, Ireland continues to remain relatively free from oil pollution, and in comparison to previous years, the overall extent of oil pollution is less. No oil spillages were associated with offshore petroleum development.

C-0724-78
TANKER TOTAL LOSSES 1964-1977 AND WORLDWIDE TANKER CASUALTY RETURNS - 1ST QUARTER 1978
[Tanker Advisory Center, Inc.]. 1978.
Tanker Advisory Center. Newsletter, June 4, 1978.

Tankers, Oil spills, Statistics

The title data are tabulated. Age of vessel is the most frequent cause of tanker total losses (80% are 10 years of age or older). The annual percentage of numbers of tankers becoming total losses has increased from ~.35% in 1965 to ~.50% in 1977. The record 240,722 tons of oil spilled in the first quarter of 1978 is due to the Amoco Cadiz disaster.

C-0725-78
WORLDWIDE TANKER CASUALTY RETURNS 1977
[Tanker Advisory Center, Inc.]. 1978.
Tanker Advisory Center. Newsletter, March 31, 1978.

Tankers, Oil spills, Statistics

Table A shows the 1973-1977 yearly numbers of tanker losses, personnel casualties, and oil spills (including tonnages), categorized by cause. Other tables present the distribution of tanker casualties by size, age, and flag for 1974-1977, with 1977 again detailed by cause. Oil spills increased in 1977 both in reported incidents and the total quantity lost to the water.

C-0726-78
PRELIMINARY REPORT - BEDFORD INSTITUTE OF OCEANOGRAPHY SCIENTIFIC VISIT TO "AMOCO CADIZ" SPILL SITE
Vandermeulen, J.H., D.E. Buckley, E.M. Levy, B.F.N. Long, et al. 1978.
Spill Technology Newsletter 3(2):7-14.

Amoco Cadiz spill, Environmental effects, Mortality, Marine organisms, Intertidal zone, France

The chronology of the Amoco Cadiz spill, the French cleanup and scientific participation in follow-up studies are reported. Major observations by the title group of scientific observers are reported. Among the observations noted were the high chemical/biological oxygen demand of the oil and its possible environmental impact; the geomorphology of the shoreline which permitted retention and recontamination from buried oil; and the widespread mortality of certain mollusks, crustaceans, and echinoids versus the survival of limpets, burrowing annelids, and soft-shelled clams.

2. MONITORING

C-0727-78
CROMARTY-MORAY FIRTH MONITORING (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(5):117.

Monitoring, Environmental deterioration, Refineries, Oil terminals, UK

A marine monitoring program was developed for the title region to aid the detection of any environmental deterioration. Nigg Point on Cromarty Firth is the planned site of a crude oil refinery and marine terminal.

C-0728-78
OIL WARNING DEVICES IN WATER POLLUTION CONTROL [in German]
Becker, S., and H. Heitman. 1977.
Wasserwirtschaft-Wassertechnik 27(3):77-78, 82.

Monitoring, Remote sensing, Chemical analysis, *Fluorometry

Various techniques for monitoring oil pollution and the basic principles involved are reviewed.

[from Environmental Health and Pollution Control 13(1):#75. 1978]

C-0729-78
CONTINUOUS DETERMINATION OF THE OIL UPTAKE OF A FLOWING AQUEOUS LIQUID
Berthold, R., and H.D. Hess. 1978.
German Offenlegungsschriften (unexamined patent application) 2,637,695

Monitoring, Uptake, Chemical analysis, Patent, *Fluorometry

Fluorometry determination is used in measuring oil uptake by water from oil sources such as leakage or transportation into cooling water, for example. The background fluorescence of water is determined before the contact with the oil source to prevent interference from bacteria, algae, detergents, or sources of fluorescence other than oil.

[from Chemical Abstracts 88(20): #14144b. 1978]

C-0730-78
AN INFRARED MONITOR FOR OIL IN WATER
Le Roux, J.H. 1975.
Colloquium Spectroscopicum, Internationale, 18th, 1975. Vol. 1:114-118. Proceedings.

Monitoring, Chemical analysis, Equipment, *Infrared detection

An automated apparatus is described which extracts oil from a continuous stream of rising water with CCl_4 and, at regular intervals, conveys the extract to an IR cell for oil detection. The detection limit is <1 mg/L.

[from Chemical Abstracts 88(2):#11662k. 1978]

C-0731-78
MONITORING DEVICE FOR OIL-CONTAINING WATER
Louden, L.R., C.A. Blessington, and J.L. Beatty. 1977.
German Offenlegungsschriften (unexamined patent application) 2,712,607

Monitoring, Detection, Equipment, Patent, *Fluorescence analysis

"A device for monitoring the fluorescence of water and thus determining its oil content has means for injecting a washing solution into the detection cell to remove impurities which could interfere in the analysis."

[from Chemical Abstracts 88(2):#11544y. 1978]

C-0732-78
DEVELOPMENT OF A SYSTEM TO DETECT AND MONITOR SEDIMENT POLLUTION
Nacci, V.A. 1976.
Rhode Island University report, Contract DI-14-34-0001-5040.
(Department of Civil and Ocean Engineering.)

Monitoring, Detection, Sediments, Soil, Fuel oil, *Electrical resistivity

A modified electrical resistivity device was used to study laboratory and offshore sediment pollution. Many pollutants, including fuel oil, were used in the laboratory samples. Results of the lab study showed that the presence of pollutants altered the electrical resistivity of the sediment.

[from Aquatic Sciences and Fisheries Abstracts Part I 8(1):#658-1Q8. 1978]

C-0733-78
ENVIRONMENTAL MONITORING
National Research Council. Study Group on Environmental Monitoring. 1977.
Washington, D.C., National Academy of Sciences, 1977. xiii + 181 p.

Monitoring, EPA, Environmental management, Government agencies

A study was undertaken at the request of the US Congress to assess the effectiveness of EPA's current environmental monitoring programs. In this report, the Study Group describes the deficiencies in these programs and presents recommendations for their improvement. Included are sections on current monitoring activities, purposes of monitoring, EPA's management of scientific data, and development of more effective national monitoring. Extensive appendices are also included.

C-0734-78
ENVIRONMENTAL PROTECTION ON SHIPS (PART 5) [in German]
Seibel, D. 1977.
Seewirtschaft 9(1):16-20.

Monitoring, Incineration, Oil-water separation, Ships, Pollution prevention, Ballast, Wastewaters

The paper describes installations for monitoring and preventing pollution on ships. Installations for incinerating waste oil, removing oil from bilge, ballast and cooling water, and monitoring oil quantity in waste water are discussed.

[from Environmental Health and Pollution Control 13(1):#150. 1978]

3. REMOTE SENSING

C-0735-78
MEASUREMENT OF LUMINESCENCE OF GEOCHEMICALLY STRESSED TREES AND OTHER MATERIALS
Hemphill, W.R., R.D. Watson, R.C. Bigelow, and T.D. Hessen. 1977.
US Geological Survey Professional Paper 1015:93-112.

Remote sensing, Oil slicks, Natural seepage, *Luminescence, *Fraunhofer line discriminator

An airborne Fraunhofer line discriminator (FLD) was used to detect solar-stimulated luminescence of various natural ground cover materials and nearshore oil slicks. "Luminescence of thick nearshore oil slick layers from a natural marine seep is 10 times that of open water; thinner layers dispersing seaward are marginally detectable."

[from Chemical Abstracts 88(6):#39901m. 1978]

C-0736-78
STUDY FOR A EUROPEAN SURVEILLANCE SYSTEM FOR THE DETERMINATION OF AIR AND WATER POLLUTION BY MEANS OF ENVIRONMENT AND EARTH RESEARCH SATELLITES
Kaminski, H. 1976.
International Journal of Ecology and Environmental Sciences 2(2/3): 129-158.

Remote sensing, Monitoring, Surveillance, Legislation, Europe, *Satellites

A summary of general air and water pollution sources and problems in Europe is given and the use of remote sensing techniques for monitoring pollution is discussed. A timetable for the development of a research program for a satellite surveillance system in Europe and eventually the world is proposed. Emphasis is placed on making pollution data available to legislative bodies.

C-0737-78
REMOTE SENSING OF COASTAL WETLAND VEGETATION AND ESTUARINE WATER PROPERTIES
Klemas, K. 1975.
Estuarine Processes, Vol. 2: Circulation, Sediments, and Transfer of Material in the Estuary. M. Wiley (ed.). New York, Academic Press, Inc., 1977. p. 381-403.

Remote sensing, Detection, Monitoring, Coasts, Estuaries

The paper reviews various uses of remote sensing techniques in coastal and estuarine areas. Discussed are applications for tracking, identifying, determining the concentration, and monitoring the movement and dispersion of water pollutants, including oil.

C-0738-78
A STUDY OF DENSITY FRONTS AND THEIR EFFECTS ON COASTAL POLLUTANTS
Klemas, V. and D.F. Polis. 1977.
Remote Sensing of Environment 6(2):95-126.

Remote sensing, Models, Drift, Spreading, Delaware Bay, *Density fronts, *Satellites, *LANDSAT

A study of different types of density fronts was conducted in Delaware Bay using boats, satellites, and aircraft in order to improve a model for oil drift and spreading. "LANDSAT satellites provided the most effective means of determining the location and extent of frontal systems over all portions of the tidal cycle." Satellite observations were in agreement with boat measurements and model predictions.

[from Environmental Health and Pollution Control 13(2):#343. 1978]

C-0739-78
LASER-INDUCED FLUORESCENCE AND ENVIRONMENTAL SENSING
Measures, R.M. 1975.
Applied Laser Spectroscopy, A Digest of Technical Papers Presented at the Spring Conference, Anaheim, California, March 19-21, 1975. Paper FB5. 6p.

Remote sensing, Detection, *Laser-induced fluorescence

"Laser-induced fluorescence was used for detection and identification of organic matter, such as fish oils and petroleum, in bodies of water. Measurement of the decay time of the fluorescence provides some improvement in the discriminatory power of a laser fluorosensor without modification to the laser."
[from Chemical Abstracts 88(2):#11660h. 1978]

C-0740-78
REMOTE SENSING APPLIED TO ENERGY-RELATED PROBLEMS: A MANUAL (book review)
Nettles, D.E. 1977.
Journal of Environmental Science and Health A12(9):507-508.

Remote sensing, Fossil fuels, Development, Monitoring, Environmental effects, Book review

The title book [University of Miami. Coral Gables, Florida, University of Miami, 1976. vii + 416 p.] is briefly summarized and favorably reviewed. The text is a series of papers presented at a symposium at the University of Miami on December 2-4, 1974. Chapter 4 deals with remote sensing of nuclear and fossil fuels, development planning, and environmental analysis; and Chapter 5 reviews several environmental quality monitoring techniques. [possibly oil pollution related]

4. SAMPLING

C-0741-78
A RAPID FIELD METHOD FOR DETECTING OIL IN SEDIMENTS
Brown, L.R., G.S. Pabst, and M. Light. 1978.
Marine Pollution Bulletin 9(3):81-82.

Sampling, Sediments, Crude oil, Chromatography, Argo Merchant spill, *Field method

"A rapid thin-layer chromatographic technique for estimating the relative concentration of crude oil in sediments has been developed. The limit of detection on the chromatogram is 2µg of Empire Mix or Saudi Arabian crude oil. The technique has been tested on 335 sediment samples collected from 67 stations in the Gulf of Mexico and has been utilized in assessing the location of oil entering the sediments from the Argo Merchant spill incident."

C-0742-78
AROMATIC HYDROCARBONS IN BENTHIC ORGANISMS FROM COASTAL AREAS POLLUTED BY IRANIAN CRUDE OIL
Grahl-Nielsen, O., J.T. Staveland, and S. Wilhelmsen. 1978.
Journal of the Fisheries Research Board of Canada 35(5):615-623.

Sampling, Chemical analysis, Aromatic hydrocarbons, Marine organisms, Benthos, Crude oil, Norway

Samples of oil, water, and benthic organisms were collected over a period of one year from the West coast of Norway, the site of an Iranian crude oil spill, and analyzed for various aromatic hydrocarbons. The results are presented and discussed.

C-0743-78
HYDROCARBONS IN MARINE ORGANISMS AND SEDIMENTS OFF WEST GREENLAND
Johansen, P., V.B. Jensen, and A. Buchert. 1977.
Technical Report - Fisheries and Marine Service (Canada) No. 729. 33 p.

Sampling, Hydrocarbons, Sediments, Marine organisms, Metabolism, Greenland

Sediments had about 0.4 µg/g dry weight total hydrocarbons, indicating a low pollution level of water from petroleum. Organisms tested were extremely variable in their hydrocarbon content, probably because of differences in metabolic activity. The main hydrocarbons identified were pristane and pentane.

[from Chemical Abstracts 88(7):#49159q. 1978]

C-0744-78
SAMPLING OF WATER AND WASTEWATER
Shelley, P.E. 1977.
Report EPA/600/4-77/039, Contract EPA-6-99-3131. 322 p. Final report.
(Supersedes report dated September 1976, PB-259 946.)

Sampling, Wastewaters, Water quality, Equipment, Monitoring

This report addresses the title topic in terms of a water quality monitoring program. Practical considerations reviewed include sample types, frequency of sampling, site selection, and sample quantity, preservation, and handling. There is discussion and an appended form of evaluations of automatic samplers covering 250 models of commercially available samplers and 16 custom built devices [possibly oil pollution related].

[from Government Reports Announcements 77(26):#PB-272 664/4GA. 1977]

C-0745-78
CAUTION IN THE USE OF NISKIN BOTTLES FOR HYDROCARBON SAMPLES
Zsolnay, A. 1978.
Marine Pollution Bulletin 9(1):23-24.

Sampling, Contamination, Analytical techniques, *Niskin bottles

Hydrocarbons that have a distribution similar to a petroleum product may be introduced into a water sample by the Niskin bottle that was used to collect the sample. Results indicate that the artifacts released by the Niskin Sampler do not contain branched and/or aromatic hydrocarbons however.

5. ANALYSIS

C-0746-78
SPECTROSCOPIC CHARACTERIZATION OF PETROLEUM-DERIVED POLLUTANTS IN THE SEA [English summary]
Albaiges, J., J. Rivera, M.R. Cuberes, A. Figueras, and J. Torradas. 1975.
Colloquium Spectroscopicum Internationale, 18th, Vol. 2:307-312.

Spectroscopy, Hydrocarbons, Seawater

IR, UV, and MS methods were evaluated to characterize oil pollution samples. Mass spectroscopy appears to be the most appropriate technique for measuring isoprenoid hydrocarbons, which are present in large amounts in petroleum and are highly resistant to environmental degradation.

[from Chemical Abstracts 88(10):#65722y. 1978]

C-0747-78

RECRUITMENT OF BENTHIC ANIMALS AS A FUNCTION OF PETROLEUM HYDROCARBON CONCENTRATION IN THE SEDIMENT
Anderson, J.W., R.G. Riley, and R.M. Bean. 1978.
Journal of Fisheries Research Board of Canada 35(5):776-790.

Benthos, Hydrocarbons, Sediments, Intertidal zone, Chromatography, Release, *Recruitment

Hydrocarbon depuration rates and recruitment of benthic organisms were measured in three field installations of oiled and clean, fine and coarse sediments in the intertidal region of Sequim Bay, Washington. Hydrocarbons were analyzed by glass capillary gas chromatography. Depuration rates were much greater in coarse than in fine sediments. Recruitment of benthic organisms was not significantly inhibited in any of the installations.

C-0748-78

THE ANALYSIS AND CONTROL OF VOLATILE HYDROCARBON CONCENTRATIONS (E.G. BENZENE) DURING OIL BIOASSAYS
Atkinson, L.P., W.M. Dunstan, and J.G. Natoli. 1977.
Water, Air, and Soil Pollution 8(2):235-242.

Bioassay, Growth, Phytoplankton, Hydrocarbons, Uptake, *Experimental design, *Benzene

The importance of experimental design in studying the effect of benzene uptake on growth in phytoplankton was examined. The experiment indicated that benzene is quickly lost to the atmosphere from flasks stoppered with cotton, but not from rubber-stoppered flasks with little headspace. The results suggest that ambient benzene concentrations may be lower than published literature figures by an order of 10 to 100. The growth rate of *Skeletonema* sp. was reduced at benzene concentrations above 10 to 20 ppm.

C-0749-78

POLYCYCLIC AROMATIC HYDROCARBONS - ANALYSIS OF COMPLEX MIXTURES BY PROBE DISTILLATION AND LOW VOLTAGE MASS SPECTROMETRY
Blumer, M. 1975.
Finnigan Spectra 5(3):8-10.

PAH, Analytical techniques, Distillation, Spectrometry, Chromatography

"Polycyclic aromatic hydrocarbons (PAH) were separated from the environmental samples by a combination of gel filtration column chromatography and charge transfer complexation and analyzed by probe distillation and low-voltage mass spectroscopy. The technique is rapid (3-5 min/run), and the separation is accomplished in the high vacuum of the spectrometer."

[from Chemical Abstracts 88(10):#68689d. 1978]

C-0750-78

POLYAROMATIC HYDROCARBONS IN OYSTERS FROM COASTAL LAGOONS ALONG THE EASTERN COAST OF THE GULF OF MEXICO, MEXICO

Bravo, H., S. Salazar L., A.V. Botello, and E.F. Mandelli. 1978.
Bulletin of Environmental Contamination and Toxicology 19(2):171-176.

PAH, Chemical analysis, Chromatrography, Gulf of Mexico, *Crassostrea virginica

A method for the analysis of polynuclear aromatic hydrocarbons (PAH) is described. The analysis was performed on specimens of the oyster Crassostrea virginica collected from lagoons and estuaries along the eastern coast of the Gulf of Mexico. The PAHs were analyzed by capillary column gas chromatography.

C-0751-78

DETERMINATION OF TRACE LEVEL HYDROCARBONS IN MARINE BIOTA

Chesler, S.N., B.H. Gump, H.S. Hertz, W.E. May, and S.A. Wise. 1978.
Analytical Chemistry 50(6):805-810.

Chemical analysis, Hydrocarbons, Chromatography, Spectrometry, Marine organisms

A method utilizing headspace sampling, gas chromatography, and GC/MS is described for the determination of petroleum hydrocarbons in marine biota.

[from Chemical Abstracts 88(23):#164955h. 1978]

C-0752-78

METHODS FOR ANALYSIS OF TRACE LEVELS (μg/kg) OF HYDROCARBONS IN THE MARINE ENVIRONMENT

Chesler, S.N., B.H. Gump, H.S. Hertz, W.E. May, and S.A. Wise. 1977.
National Bureau of Standards Special Publications Vol. 464:81-85.

Chemical analysis, Sampling, Chromatography, Hydrocarbons, Contamination, *Trace levels

The use and advantage of headspace sampling and coupled-column liquid-chromatography either alone or in combination are described as suitable techniques in the title determinations. Both methods require minimal sample handling and together provide for effective analysis of naphthalenes and substituted naphthalenes as well as high molecular weight nonvolatile compounds such as benzopyrenes.

[from Chemical Abstracts 88(18):#126109c. 1978]

C-0753-78
THE RECOGNITION OF ORGANIC POLLUTANTS IN AQUATIC SEDIMENTS
Eglinton, G., B.R.T. Simoneit, and J.A. Zoro. 1975.
Proceedings of the Royal Society of London, Series B 189(1096):415-442.

Source identification, Hydrocarbons, Biogenic hydrocarbons, Sediments, GC/MS

Aquatic sediments contain organic matter contributed from a variety of natural and anthropogenic sources. Recent sediments need to be analyzed for baseline data so that pollutants can be distinguished from natural compounds. Computerized GC/MS provides this capability, and the technique is described in detail. Use of the method for distinguishing partially degraded crude oil, polynuclear aromatic hydrocarbons and other organic substances in an estuarine sediment is demonstrated.

C-0754-78
MANUAL OF METHODS IN AQUATIC ENVIRONMENT RESEARCH. PART 4. BASES FOR SELECTING BIOLOGICAL TESTS TO EVALUATE MARINE POLLUTION
Food & Agricultural Organization of the United Nations. 1977.
FAO Fisheries Technical Paper No. 164.

Bioassay, Biological effects, Toxicity, Monitoring, Sources, *Biological tests

"This manual is intended to offer help to beginners in one particular field: selecting appropriate methods for bioevaluation of marine pollutants." Included are sections on sources of marine pollution, purposes of tests, types of procedures, selection of test organisms, and interpretation of test results.

C-0755-78
DEVICE FOR DETERMINING SMALL CONCENTRATIONS OF HIGH-BOILING PETROLEUM PRODUCTS IN WATER
Gokhberg, Zh.L., and G.A. Eremeeva. 1978.
USSR Patent 587,381

Sampling, Petroleum products, Equipment, Patent

"In a device containing a chamber, contact electrodes, and an interelectrode sorption filler, the sensitivity is improved by using a layer of Fe-containing glass beads as the interelectrode sorption fillers."

[from Chemical Abstracts 88(18):#126151k. 1978]

C-0756-78
METHODS OF SEAWATER ANALYSIS
Grasshoff, K. 1976.
Weinheim, West Germany, and New York, Verlag Chemie, 1976. 317p.

Chemical analysis, Seawater, Hydrocarbons

Analytical procedures are described for the determination of the various constituents of seawater, including organic carbon and aromatic hydrocarbons. [possibly oil pollution related]

[from Water, Air, and Soil Pollution 9(1):126-127. 1978]

C-0757-78
HIGH-PRESSURE LIQUID CHROMATOGRAPHIC DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER [English summary]
Hagenmaier, H., R. Feierbend, and W. Jaeger. 1977.
Zeitschrift fuer Wasser und Abwasser Forschung 10(3-4):99-104.

Chemical analysis, Chromatography, PAH, Water quality

"A routine analytical method was developed for the detection of polycyclic aromatic hydrocarbons in drinking water, based on separation by cyclohexane extraction and reversed-phase, high-pressure liquid chromatography. Identification was by fluorescence spectroscopy." Several PAHs, which may be components of petroleum, were detected.

[from Chemical Abstracts 88(2):#11657n. 1978]

C-0758-78
PREPARATIVE-SCALE LIQUID CHROMATOGRAPHIC FRACTIONATION OF CRUDE OILS DERIVED FROM COAL AND SHALE
Jones, A.R., M.R. Guerin, and B.R. Clark. 1977.
Analytical Chemistry 49(12):1766-1771.

Analytical techniques, Chromatography, Crude oil, Oil shale, *Coal oil

A procedure is described for the separation of crude oils derived from shale and coal. "This procedure is designed to produce large quantities of fractions for biological testing with minimal alteration of sample composition."

[from Biological Abstracts 65(6):#36973. 1978]

C-0759-78
SPECTROFLUOROMETRIC STUDY OF PETROLEUM FRACTIONS AND CRUDES OF DIFFERENT ORIGIN. A METHOD FOR THE DETERMINATION OF PETROLEUM IN SURFACE WATERS
Kasa, I., and G. Bajnoczy. 1977.
Periodica Polytechnica, Chemical Engineering 21(2):199-209.

Detection, Chemical analysis, Crude oil, Wastewaters, *Spectrofluorometry

"A spectrofluorometric method using 1,2-dichloroethane as extractant was developed for the detection of petroleum in surface waters and wastewaters. The fluorescent light intensity is linearly related to petroleum concentration at 1-8 ppm, at excitation wavelengths of 240-280 nm and emission measurement at 340-360 nm."

[from Chemical Abstracts 88(6):#41459s. 1978]

C-0760-78
ERROR OF MEASUREMENT OF OILY MATTER IN WASTE WATER
Kume, H. 1976.
Journal of the Faculty of Engineering. University of Tokyo, Series A, No. 14:68-69.

Detection, Wastewaters, Chemical analysis, Surfactants, Extraction, *Measurement error

"In the JIS K 0102 method for detection of oil in wastewater, hexane extraction is used. The measurement error was detected in interlaboratory analyses and the effect of surfactants on the measured values was studied. The effect of surfactants on the measured values is discussed."

[from Chemical Abstracts 88(8):#54652z. 1978]

C-0761-78
ANALYTICAL DETERMINATION OF PETROLEUM PRODUCTS IN WATER [English summary]
Lehocky, J. 1977.
Vodni Hospodarstvi [Rada] B, Priloha 27(8):210-213.

Analytical techniques, Petroleum products, Wastewaters, Groundwater

Analysis of petroleum products in wastewaters and underground waters is discussed in this review with 8 references. Various analytical techniques and their applicability are considered.

[from Chemical Abstracts 88(20):#141291z. 1978]

C-0762-78
PRELIMINARY ASSESSMENT OF THE PRESENCE OF OIL IN THE ECOSYSTEM AT EKOFISK AFTER THE BLOWOUT, APRIL 22-30, 1977
Mackie, P.R., R. Hardy, and K.J. Whittle. 1978.
Journal of the Fisheries Research Board of Canada 35(5):544-551.

Chemical analysis, Ekofisk blowout, Fate, Sediments, Fish

The marine environment in the vicinity of the Ekofisk blowout was assayed for oil pollution immediately after the blowout was controlled and again after two months. Several analytical techniques were employed, and the results varied according to the technique used. Oil could not be detected in the water column 2 months after the blowout.

C-0763-78
CRITICAL STUDY OF THE ANALYTICAL TECHNIQUES UTILIZED FOR THE MEASUREMENT OF POLLUTION IN THE MARINE ENVIRONMENT. FIRST PART. PHYSICO-CHEMICAL PARAMETERS [in French]
Michel, P. 1976.
Revue des Travaux de l'Institut des Peches Maritimes 40(1):13-31.

Chemical analysis, Analytical techniques, Detection, Seawater

"The various methods used in E.E.C. countries for measuring the following physico-chemical parameters, in the marine environment, are described and discussed: (1) Temperature, (2) pH, (3) Salinity, (4) Dissolved O_2, (5) Nitrites, (6) Nitrates, (7) Ammonia, (8) Phosphates, (9) Suspended materials, (10) Dissolved organic matter." The best methods are indicated. [possibly oil pollution related]

[from Applied Ecology Abstracts 4(3):#3205-D4. 1978]

C-0764-78
ORGANIC TRACE POLLUTANTS. HYDROCARBONS [in French]
Michel, P. 1976.
Revue des Travaux de l'Institut des Peches Maritimes 40(1):93-106.

Chemical analysis, Sampling, Hydrocarbons, Biogenic hydrocarbons, Sediments, Seawater

Analysis of trace hydrocarbons in the ocean is complicated by such problems as low concentrations and the presence of naturally occurring biogenic hydrocarbons. This article presents a review of sampling methods for water and sediments, collection and purification of the lipid fraction, and analysis of the hydrocarbons.

[from Chemical Abstracts 88(6):#41331u. 1978]

C-0765-78
DETERMINATION OF OILS [IN WATER] USING IR ABSORPTION SPECTROMETRY AND THIN LAYER CHROMATOGRAPHY. PART 2. [in Japanese]
Miyasaki, E., A. Uekaki, H. Sato, and M. Sone. 1977.
Miyagi-ken Kogai Gijutsu Senta Hokoku Vol. 5:39-43.

Chemical analysis, Chromatography, Spectrometry, Crude oil, Petroleum products, *Gravimetry

With the standard gravimetric method for oil determination, crude and heavy petroleum oils lose a large quantity of light hydrocarbons during the heating step. The presence of anionic or cationic surfactants interferes with both the gravimetric and chromatography-IR method. Various wastewaters were tested by the IR and gravimetric method, yielding a correlation coefficeint γ=0.98, η=20.

[from Chemical Abstracts 88(16):#110091e. 1978]

C-0766-78
DETERMINATION OF THE DISPERSED OIL IN WASTE WATER BY DUAL-WAVELENGTH SPECTROPHOTOMETRY [English summary]
Saito, T., K. Hagiwara, Y. Murakami, and K. Higashi. 1977.
Asaka Kogyo Gijutsu Shikensho Kiko 28(3):185-190.

Analytical techniques, *Dual-wavelength spectrophotometry, Wastewaters, *Dispersed oil

The selected wavelength for the measurement of the dispersed oil was 240 nm, and 400 nm was used for the measurement of the background absorption. These wavelengths were selected to avoid interference from surfactants used as emulsifiers and various inorganic ions, e.g., Cl^-, Br^-, I^-, NO_3^-, and SO_4^{2-}. The addition of 10 ppm nonionic surfactant reduced the time of shaking the dispered oil sample from >300 min to 60 min.
[from Chemical Abstracts 88(20):#141241h. 1978]

C-0767-78
QUANTITATIVE DETERMINATION OF PETROLEUM PRODUCTS IN INDUSTRIAL WASTE WATER [in Russian]
Smol'yaninov, G.A., N.N. Semin, and L.S. Krivitskaya. 197
Sbornik Nauchnykh Trudov Gazovoi Kromatografii Vol. 26:50-53.

Chromatography, Chemical analysis, Petroleum products, Wastewaters

"A hexane extract was gas chromatographed to determine paraffinic components."

[from Chemical Abstracts 88(18):#126002n. 1978]

C-0768-78
SOME CONDITIONS FOR USE OF MACRORETICULAR RESINS IN THE QUANTITATIVE ANALYSIS OF ORGANIC POLLUTANTS IN WATER
Stepan, S.F., and J.F. Smith. 1977.
Water Research 11(4):339-342.

Chemical analysis, Extraction, Contaminants, Adsorption, *Macroreticular resins

Conditions for obtaining the most accurate results in extracting trace organic pollutants by adsorption on macroreticular resins were studied. Variables studied were sample temperature, flow rate, pH, column temperature, column length, and resin type.

C-0769-78
ANALYSES OF AROMATIC HYDROCARBONS IN INTERTIDAL SEDIMENTS RESULTING FROM TWO SPILLS OF NO.2 FUEL OIL IN BUZZARDS BAY, MASSACHUSETTS
Teal, J.M., K. Burns, and J. Farrington. 1978.
Journal of Fisheries Research Board of Canada 35(5):510-520.

Aromatic hydrocarbons, Fuel oil, Sediments, Marshes, Chromatography, Spectrometry, Buzzards Bay

An analysis, using GC and MS, was performed of the two- and three-ring aromatic hydrocarbons in marsh sediments contaminated by No. 2 fuel oil spilled from the Florida and the Bouchard in Buzzards Bay, Mass. Results indicated that light molecular weight aromatics decreased more rapidly with time than the heavier compounds. The heaviest compounds increased in concentration in the Wild Harbor marsh. Possible explanations for the results are given.

C-0770-78
LITERATURE: OIL-IN-WATER ANALYSIS (product information)
[Teledyne Analytical Instruments]. 1978.
Pollution Engineering 10(5):92.

Chemical analysis, Product information, *Teledyne Analytical Instruments

Oil-in-water analysis techniques using single wavelength UV photometers and chopped-beam dual wavelength photometric analyzers are described in a 4-page brochure. The Model 660 analysis system, which utilizes ultraviolet absorption, is explained.

C-0771-78
HIGH PRESSURE LIQUID CHROMATOGRAPHY OF POLYCYCLIC AROMATICS. A SURVEY
[English summary]
Thoms, R., and M. Zander. 1977.
Erdoel und Kohle, Erdgas, Petrochemie 30(9):405-405.

Chromatography, PAH, *Survey, *HPLC

"A review with 43 references." [possibly oil pollution related]

[from Chemical Abstracts 88(10):#63838s. 1978]

C-0772-78
CONTRIBUTION OF CHRONIC PETROLEUM INPUTS TO NARRAGANSETT BAY AND RHODE ISLAND SOUND SEDIMENTS
Van Vleet, E.S., and J.G. Quinn. 1978.
Journal of the Fisheries Research Board of Canada 35(5):536-543.

Hydrocarbons, Biogenic hydrocarbons, Sediments, Chronic effects, Sources, Narragansett Bay, *Rhode Island Sound

Sediment cores from the Narragansett Bay and Rhode Island Sound were analyzed for petroleum and biogenic hydrocarbons and compared with a relatively unpolluted core sample from the Gulf of Maine. The percentage of petroleum hydrocarbons decreased with depth while the percentage of biogenic hydrocarbons increased. The percentages of unbound, humic-bound and clay- or kerogen-bound hydrocarbons in each sample were determined. The hydrocarbon pollution in Narragansett Bay and Rhode Island Sound is probably from the Fields Point Sewage Treatment Plant.

C-0773-78
THE LABORATORY ESTIMATION OF THE BIOLOGICAL EFFECTS OF ORGANIC POLLUTANTS
Wilson, K.W. 1975.
Proceedings of the Royal Society of London, Series B 189(1096): 459-477.

Chemical analysis, Analytical techniques, Biological effects, Acute effects, Toxicity, Sublethal effects

Discussed are various laboratory techniques for measuring acute toxicity, or sublethal and chronic effects of organic chemicals upon marine species. The basic requirements, advantages, and limitations of the techniques are described and assessed. Crude oils, oil dispersants, and various hydrocarbons are among the organic pollutants covered.

C-0774-78
FUEL OILS: CHEMICAL CHARACTERIZATION AND TOXICITY TO MICROALGAE
Winters, K., J.C. Batterton, R. O'Donnell, and C. van Baalen. 1977.
Pollutant Effects on Marine Organisms. C.S. Giam (ed.), Lexington, Massachusetts, Lexington Books, 1977. p. 36-37, 167-190.

Chemical analysis, WSF, Fuel oil, Phytoplankton, Algae, Toxicity, Growth

The objective of the study was to identify the compounds in WSFs of fuel oils and to examine their possible toxicity to microalgae, because these algae are primary producers in the marine environment. Using GC and MS, the authors identified phenols, anilines, indoles, pyridines, quinolines, and thiophenes, as well as the more commonly described naphthalenes and benzenes. Methylated derivatives of these compounds were also found in relatively high concentrations. Results of toxicity studies indicate "that the less volatile, more polar compounds are cause for concern," and that the unpredictable algal response suggest caution in generalizing on the toxicity of petroleums to phytoplankton.

C-0775-78
DETERMINATION OF TRACE AMOUNTS OF DISPERSED OIL IN WASTE WATER BY CARBON TETRACHLORIDE EXTRACTION - INFRARED SPECTROPHOTOMETRY
Yamaguchi, N., R. Suzuki, and R. Matsumoto. 1977.
JASCO Applied Notes Vol. 10. 7p.

Chemical analysis, Spectrometry, Extraction, Wastewaters

"Mineral, animal and vegetable oils were detected in wastewater by extraction with CCl_4 with the aid of salting-out, followed by IR spectrometry at 1710, 1750, and 1460 cm^{-1}."

[from Chemical Abstracts 88(16):#10993u. 1978]

C-0776-78
INVENTORY OF NONVOLATILE FATTY ACIDS AND HYDROCARBONS IN THE OCEANS
Zsolnay, A. 1977.
Marine Chemistry 5(4-6):465-475.

Sampling, Hydrocarbons, Distribution, Seawater, Sediments, Marine organisms

A survey of the distribution of nonvolatile fatty acids and hydrocarbons in the oceans is given. The average concentration of hydrocarbons in organisms is 0.01% by weight, 40 μg/L for surface waters, for the water column, 10 μg/L, and for sediments, 5 μg/g. These data are based on a literature review, and 66 references are included.

C-0777-78
LACK OF CORRELATION BETWEEN GAS-LIQUID CHROMATOGRAPH AND UV ABSORPTION INDICATORS OF PETROLEUM POLLUTION IN ORGANISMS
Zsolnay, A. 1978.
Water, Air, and Soil Pollution 9(1):45-51.

Chromatography, *UV absorption, Hydrocarbons, Monitoring, Marine organisms

The results from UV absorption and GLC analyses of hydrocarbons in organisms collected from polluted sites on the rocky shores of Bermuda were compared. No significant correlation was found between the two sets of results. However, a strong correlation did exist between the unresolved envelope of the chromatograms and the total amount of pollutant hydrocarbons. The author indicates that UV absorption measurements are insufficient for monitoring non-point source oil pollution in marine organisms.

6. SOURCE IDENTIFICATION

C-0778-78
NORWAY DESIGNS LASER SYSTEM THAT IDENTIFIES OIL TYPES IN SPILLS (product information)
Anon. 1977.
Canadian Shipping and Marine Engineering 48(8):33.

Source identification, Oil spills, Detection, Platforms, Oil transfer, Norway, *Laser system

This article describes a laser system developed in Norway which is able to detect immediately, locate and analyze oil spillages at sea. The system is designed for use on oil platforms, at refineries for tanker loading and unloading, and aboard aircraft.

[from Aquatic Sciences and Fisheries Abstracts. Part 1 8(1):#691-1Q8. 1978]

C-0779-78
OIL SPILL "FINGERPRINTING" WITH GAS CHROMATOGRAPHY
Flanigan, G.A., and G.M. Frame. 1977.
Research/Development 28(9):28-30, 32, 34, 36.

Source identification, Crude oil, Fuel oil, Chromatography, Chemical analysis

Distinctive and positive source identification of fuel oil and crude oil spills is provided by gas chromatography with N-P detection capability. Sixty-one oils were surveyed for N-patterns.

[from Chemical Abstracts 88(4):#27537j. 1978]

C-0780-78
LAND SOURCES OF MARINE ORGANIC MATTER
Handa, N. 1977.
Marine Chemistry 5(4-6):341-359.

Source identification, Seawater, Sources, Oil spills, *Organic matter

"A review with 107 references [is presented] of organic matter in seawater derived from various species of marine plants, river run-off, airborne materials of terrestrial origin, and oil spills."

[from Chemical Abstracts 88(14):#94534u. 1978]

C-0781-78
CHARACTERIZATION AND IDENTIFICATION OF SPILLED OILS BY HIGH SPEED GEL PERMEATION CHROMATOGRAPHY USING AN ULTRA-VIOLET ABSORPTION DETECTOR [English summary]
Higashi, K., and K. Hagihara. 1977.
Osaka Kogyo Gijutsu Shikensho Kiho 28(2):148-150.

Source identification, Crude oil, Chromatography, Weathering, Sampling

The molecular weight distribution of 8 crude oil samples diluted with THF was measured by high-speed LC using a column packed with HSG-15. A 3-year weathering experiment showed chromatograms of weathered crude oils to be similar. "The proposed method can be applied to the identification of spilled oil samples with accurate results, satisfactory reproducibility, and good sensitivity."

[from Chemical Abstracts 88(12):#78651z. 1978]

C-0782-78
OIL SPILL IDENTIFICATION SYSTEM
US Coast Guard. 1977.
Report CGR/DC-13/77, USCG-D-52-77. 207 p. Final report Oct. 74-June 77. (Update of Report USCG-D-41-75.)

Source identification, Chemical analysis, Sampling, Manuals, USCG, Safety, Weathering

The report issued in October 1974 has been revised to include the latest techniques developed for sampling, sample handling and transmittal, gas chromatography, fluorescence and infrared spectrophotometry, and thin-layer chromatography, as used by the USCG operational laboratory. An infrared field manual, infrared field classification manual, oil weathering simulation technique, and section on safety precautions are also included.

[from Government Reports Announcements 77(25):#AD-A044 750/8GA. 1977]

B. OIL POLLUTION PREVENTION AND CONTROL

1. SPILL CONTAINMENT

C-0783-78
HIGH SPEED OIL DEFENCE BOAT (product information)
[Vator Oy Co.]. 1978.
Marine Pollution Bulletin 9(1):3.

Spill containment, Booms, Product information, *Vator Oy Co.

Vator Oy of Helsinki has developed an oil defence boat that can travel 60 km/hr (30 kn) and dispense a 200 m floating plastic barrier within 20 min to surround a polluted area or protect a nearby area. The Vator 18T boat can carry a crew of 3 or 4, and the barrier (Nokia SUP Spillbooms) is made from a PVC-coated fabric enclosing floats of polythene foam and either chain ballast or iron sinkers.

2. CLEANUP AND REMOVAL

C-0784-78
DEALING WITH OIL SPILLS IN COASTAL WATERS
Anon. 1978.
OCS Update 3(3):3-4.

Spill cleanup, Dispersants, Combustion, Biodegradation, *Coastal waters

If conventional spill containment and recovery methods have failed, oil slicks can be eliminated by combustion, use of dispersants, weighting agents, or biodegradation aids. The first 3 methods mentioned have disadvantages which limit their usefulness; the last method has not been adequately tested in the field. If nothing is done, much of the oil may evaporate; that which hits the shoreline is likely to have serious ecological and economic impacts.

C-0785-78
ROUND-THE-WORLD NEWS: BLACK SEA (product information)
Anon. 1978.
Marine Pollution Bulletin 9(1):6.

Spill removal, Ice, Harbor, Equipment, Black Sea

The Black Sea Central Design Bureau has developed an oil collector for use with polluted harbor ice. The collector is towed by a small tug, melts the pieces of ice, and feeds the water through a cleaning plant. Tests have been conducted with "good" results.

C-0786-78
DISPERSING AGENT FOR SEPARATING PETROLEUM AND PETROLEUM PRODUCTS FROM A WATER SURFACE
Abaeva, T.V., N.M. Antonova, Y.K. Lukmanov, O.S. Mochalova, et al. 1977.
German Offenlegungsschriften (unexamined patent application) 2,626,552.

Spill cleanup, Dispersants, Patent

"Aqueous solutions of the phosphate $[R(OCH_2CH_2)_nO]_2PO_2M$ ($R=C_{7-12}$ alkyl, $n=4\text{-}6$, M=alkali metal) are nontoxic dispersants for spills of petroleum products on water."

[from Chemical Abstracts 88(8):#54808e. 1978]

C-0787-78
ADSORPTION-TYPE OIL FENCE
Abe, Y., S. Tomita, Y. Matsuda, and K. Teragima. 1977.
Kogyo Shiryo 11(7):141-152.

Spill cleanup, Adsorption, *Peat and fibers, *Review

"A review, with 6 references, with emphasis on peat or palm tree fibers for oil spill management."

[from Chemical Abstracts 88(12):#78721x. 1978]

C-0788-78
STUDIES OF POSSIBLE USE OF SORBING MATERIALS FOR ELIMINATING OIL SPILLS IN THE SEA [English summary]
Anufrieva, N.M., M.P. Nesterova, and A.B. Gornitskii. 1977.
Okeanologiya (Moscow) 17(6):1016-1021.

Absorption, Spill removal, *Foam, *Polyurethane

The capabilities of PVC formaldehyde-phenol resin foams and polyurethanes to clean oil spills from seawater surfaces were tested. The heavy PVC foams sink. The best results were obtained using polyurethane foam which absorbs 18.6 times its weight. The foam absorbed the oil in <5 min on a surface of 46 cm^2 with 50 ml of oil. The foam absorbs insignificant amounts of water.

[from Chemical Abstracts 88(22):#158094k. 1978]

C-0789-78
ON THE EFFICIENCY OF INDIAN POLYURETHANE FOAMS IN ABSORBING SPILLED OIL
Bhandare, M.V., and R. Sen Gupta. 1976.
Mahasagar 9(1-2):67-69.

Absorption, Spill cleanup, Fuel oil, *Diesel oil, *Polyurethane foam

"The oleophilic properties of one brand of polyurethane foam sheets and foam powder, manufactured in India, was tested using ordinary diesel oil. The sheet could absorb 72% of its own weight of oil while the powder could absorb 55%. With increasing quantity of oil the absorbing capacity decreased for both the foam sheet and the foam powder."

[from Aquatic Sciences and Fisheries Abstracts, Part 1 8(1):#817-108. 1978]

C-0790-78

ADSORPTION PRODUCT FOR ADSORBING OIL ON THE SURFACE OF WATER

Couderc, P. 1977.
French Demande 2,333,564

Adsorption, Spill removal, Patent, *Perlite

"Perlite or vermiculite is treated with a cationic fluoroorganic wetting agent $[C_nF_{2n+1}(CH_2)_x N^+ RR^1CH_2CH(OH)R^2]m\ X^{m-}$ ($R = C_{1-9}$ alkyl; $R^1 = C_{1-8}$ alkyl, C_{6-10} aryl, C_{5-9} cycloalkyl, or $CH_2CH(OH)R^2$; R^2 = H or Me; X = SO_4, alkyl sulfate, halogen, PO_4, or OAc; n = 1-20, X = 2-4, and m = 1-3) to make it hydrophobic and effective in clearing up oil spills."

[from Chemical Abstracts 88(20):#141458j. 1978]

C-0791-78

OIL POLLUTION

Cormack, D. 1977.
Chemistry and Industry No. 14:605-608.

Dispersants, Toxicity, Environmental effects, Spill removal, *Torrey Canyon* spill, UK

An assessment is made of progress since the 1967 *Torrey Canyon* disaster in dealing with oil spills. Briefly reviewed are dispersants and their environmental implications, devices and methods for recovering spilled oil, and future research directions in the UK. Work conducted by the Warren Spring Laboratory is highlighted.

C-0792-78

INCINERATORS FOR OIL SPILL CLEANUP

Ewin, H.B. 1978.
Spill Technology Newsletter 3(3):21-22.

Spill disposal, Incineration, Equipment, Canada

Briefly reviewed is the disposal of recovered oil spill materials by incineration. The Environmental Emergency Branch of Canada's Environmental Protection Service is currently evaluating several types of incinerators for their suitability in disposing of oil spill materials. Portability, low cost, and ease of construction are major criteria in this evaluation.

C-0793-78
ADSORPTION OF OILY OR HYDROPHOBIC LIQUIDS IN THE PRESENCE OF WATER
Fortuna, A.C., and F.A.O. Grodon Zeeman. 1976.
Brazilian Pedido PI 75 02,756

Spill cleanup, Adsorption, Emulsion, Patent, *Expanded pyrophyllite

"Oils of hydrophilic liquids, such as crude oil...are adsorbed by expanded pyrophyllite (1 kg adsorbs 8-9 kg oil from the water)."

[from Chemical Abstracts 88(8):#54947z. 1978]

C-0794-78
OIL-RECOVERING MATERIAL
Hachisu, T. and A. Uchida. 1978.
US Patent 4,066,539

Spill removal, Absorption, Patent, Sea surface, Beach cleanup

An apparatus and technique is described for cooling, granulating, and coating atactic polypropylene. The resulting material will absorb oil from water surfaces or sand beaches. The material floats on the surface after absorbing oil from water.

[from Chemicals Abstracts 88(20):#141439d. 1978]

C-0795-78
OIL REMOVAL FROM WATER
Ito, H., K. Oh, T. Sudo, and Y. Nagao. 1977.
Japanese Patent 77 32,870

Spill removal, Adsorption, Sorbents, Surfactants, Patent

Oil floating on water is removed with a plastic (except atactic polypropylene) and a small amount of hydrophilic surfactant.

[from Chemical Abstracts 88(16):#110133v. 1978]

C-0796-78
ADSORPTION OF OILS
Kobayashi, Y., R. Matuo, and M. Nishiyama. 1977.
US Patent 4,061,567

Spill cleanup, Adsorption, Patent, *Sorbent Kapok fibers

Kapok fibers have low specific gravity, higher water repellency, and are useful for adsorbing floating oil. Kapok quilts are reusable.

[from Chemical Abstracts 88(8):#54964c. 1978]

C-0797-78
FLOATING OIL-COLLECTING MAT
Kunitomo, A., and T. Saida. 1977.
Japanese Kokai (unexamined patent application) 77 78,690

Spill removal, Sorbents, *Foam mats, Patent

"Floating oil-collecting mats are made by including oleophilic foams containing independent pores in vegetable fiber-based laminates."

[from Chemical Abstracts 88(8):#54765p. 1978]

C-0798-78
RECOVERY OF OIL FROM SAND
Kusumoto, T., and M. Usukura. 1977.
Japanese Kokai (unexamined patent application) 77 81,306

Spill removal, Sediments, Beach cleanup, Patent

Oil contaminated sand is treated with a solvent such as kerosine, followed by repeated screening and flushing with water to remove the oil and slime from the sand. In a test of the process, 500g sand containing 43.74g oil was treated, resulting in sand with only 0.37g oil.

[from Chemical Abstracts 88(18):#123617f. 1978]

C-0799-78
OIL AND FAT ABSORBING POLYMERS
Marsh, H.E., Jr. 1977.
US Patent 4,039,489

Spill removal, Absorption, Solvents, Patent, *Polymers

"A method is described for forming a solid network of polymer having a minimal amount of crosslinking for use in absorbing fats and oils. The polymer remains solid at a swelling ratio in oil or fat of at least ten and provides an oil absorption greater than 900 weight percent.

[from Government Reports Announcements 77(26):#PATENT-4 039 489. 1977]

C-0800-78
THE MIT/MARINE INDUSTRY COLLEGIUM OPPORTUNITY BRIEF NO. 9. OIL SPILLS: PROBLEMS AND OPPORTUNITIES
Massachusetts Institute of Technology. 1977.
Report MIT SG-77-17, NOAA-77090104. Index No. 77-717-Zvn. 30p.

Argo Merchant spill, Spill cleanup, Equipment, Monitoring, Fate, *Accident response

The events surrounding the December 1976 Argo Merchant spill are used to illustrate the types and magnitudes of problems involved in responding to accidental oil spills. A chronology of events between the grounding and breakup of the tanker is presented. The instrumentation and research needed to deal with monitoring the quantity of oil spilled and the fate of the oil, and spill cleanup equipment, vehicles and methods are discussed.

[from Government Reports Announcements 77(26):#PB272 584/4GA. 1977]

C-0801-78
EQUIPMENT DEVELOPMENT FOR ARCTIC OILSPILL COUNTERMEASURES
Meikle, K.M. 1978.
Spill Technology Newsletter 3(3):35-41.

Spill cleanup, Spill removal, Arctic, Equipment, *AMOP

A significant part of the 5-year, 7-million dollar Arctic Marine Oilspill Program (AMOP) involves the development of improved capability for dealing with a marine oil spill in northern waters. This article summarizes the capabilities and limitations of currently available techniques and equipment and outlines the need to develop a simple, flexible system that is not labor intensive, contains and collects oil at or near the spill site, and can deal with oil accumulations scattered over very large areas. Projects planned for fiscal year 1978/1979 to address such a system concept are listed.

C-0802-78
THE CLEANUP OF OIL SPILLS FROM UNPROTECTED WATERS
Milgram, J. 1978.
Spill Technology Newsletter 3(3):42-50.

Oil spills, Spill cleanup, Booms, Skimmers, Legislation, Pollution prevention

The author categorizes oil spills in 3 ways: chronic, including discharges from refineries and ports, intermediate-sized spills in protected waters; and major spills in unprotected waters. Cleanup of major spills in open waters is discussed in terms of the dynamics of cleanup devices and 5 elements crucial to effective cleanup systems. Recommendations are made for government policy concerning pollution prevention and research directions. [Also published in Oceanus 20(4):86-94. 1977]

C-0803-78
SURFACE-ACTIVE AGENTS AND THEIR IMPORTANCE IN SOLVING SOME MARINE ECOLOGY PROBLEMS
Nesterova, M.P. 1977.
Acta Hydrochimica et Hydrobiologica 5(6):527-532.

Surfactants, Emulsions, Spill cleanup, Dispersants, Tankers, Baltic Sea

"The effects of surfactant composition, temperature and salinity on the type and stability of H_2O-oil emulsions are examined. A closed-circuit method for cleaning oil tankers, using specially compounded surfactants suitable for seawater is proposed. Laboratory tests and large-scale trials in the Baltic Sea confirmed that biodegradable nontoxic nonionic surfactants, based on oxyethylene derivaties, effectively emulsify and disperse oil films."

[from Chemical Abstracts 88(22):#158101k. 1978]

C-0804-78
SHAPED POROUS PETROLEUM PITCH PRODUCT FOR RECOVERING SPILLED OILS
Noguchi, K., S. Yoshimura, H. Tanaka, E. Kitajima, and T. Sunada. 1977.
Japanese Kokai (unexamined patent application) 77 92,237

Spill removal, Adsorption, Patent, *Shaped pitch

"Pitch containing 10-60% volatile substances, from the thermal treatment of heavy hydrocarbon oils, is mixed with a porous aggregate and shaped. The shaped pitch product has high adsorption capacity for oils and is useful for recovering spilled oils from water or seawater."

[from Chemical Abstracts 88(10):#64043r. 1978]

C-0805-78
PRODUCTS: OIL SKIMMERS (product information)
[Oil Skimmers, Inc.] 1978.
Pollution Engineering 10(5):76.

Skimmers, Product information, Equipment, *Brill Oil Skimmer

The Brill Oil Skimmer, manufactured by Oil Skimmers, Inc., automatically removes floating oil wastes. A free-floating collector tubing moves continuously on the water surface in a circular pattern. The oily wastes collect by a gravity flow system to a storage or disposal tank.

C-0806-78
REMOVAL OF OIL FLOATING ON THE SEA
Ozcorta, M.F. 1977.
Spanish Patent 448,755

Spill containment, Spill removal, Booms, Ships, Equipment, Patent

"Oil spilled on the ocean surface is contained by a boom with an opening through which the oil is transported to an extractor by an air current. The entrance of the extractor is provided with membranes which achieve an essentially complete separation of oil from water. The recovered oil is transferred to a tank ship."

[from Chemical Abstracts 88(16):#110343p. 1978]

C-0807-78
OIL RECOVERY FROM UNDER ICE
Quam, H.A. 1978.
Spill Technology Newsletter 3(3):51-74.

Spill cleanup, Ice, Rivers, Canada, Equipment, Skimmers

In March 1976, personnel from Canadian oil spill cooperatives and government agencies conducted field research to develop and evaluate methods and equipment for recovering oil from under river ice by cutting slots through the surface ice. This article details the ice cutting methods and equipment, methods of ice handling, determination of optimal slot angles, and the effective recovery of spilled oil with weir-type skimmers.

C-0808-78
WATER TREATMENT AGENT IN SHEET FORM
Sato, H., and F. Oriya. 1977.
Japanese Kokai (unexamined patent application) 77 90,486

Spill removal, Patent, Sorbents, Design-engineering

"Unwoven rayon fabric was sprayed with 10% $Mg(OH)_2$ and with 5% aqueous ethylene-vinyl acetate copolymer, dried at 80°, and the sheets laminated into a tube. Turbid water containing 5000 ppm turbine oil became clear when passed through the tube (4m/h)."

[from Chemical Abstracts 88(20):#141452c. 1978]

C-0809-78
POWDER OIL-ADSORBENT
Sato, H., F. Oriya, and H. Uchida. 1977.
Japanese Kokai (unexamined patent application) 77,127,489

Adsorption, Sorbents, Patent, Spill cleanup, *Attapulgite

The mineral attapulgite is pelletized with a 10-50% Al_2O_3 solution and heated at 150-250° C to form an adsorbent for oils.

[from Chemical Abstracts 88(18):#126027z. 1978]

C-0810-78
A CERAMIC PRODUCT CONSISTING OF SEPARATE PELLETS OF INORGANIC FIBER, BINDER AND A MATERIAL WITH CLOSED PORES FOR THE ABSORPTION AND RENDERING HARMLESS OF OIL FLOATING ON WATER IN SUCH A WAY THAT PELLETS FLOAT ON THE WATER FOLLOWING COMPLETE SATURATION WITH WATER OR OIL
Schrewelius, N.G. 1977.
Swedish Patent 396,064

Absorption, Spill removal, Patent

"In the title product, the thickness of the mineral fibers is 2-15μ, the closed cells are incorporated as thin-walled spheres, and the bulk density of the pellets is 0.20-0.70 g/cm^3."

[from Chemical Abstracts 88(20):#141276y. 1978]

C-0811-78
NEW OIL SKIMMER FROM SHELL (news brief)
[Shell Development Company]. 1978.
Marine Pollution Bulletin 9(6):145.

Skimmers, Spill removal, Product information, Design-engineering, USCG, *ZRV Skimmer

The Zero-Relative-Velocity (ZRV) Skimmer, developed by Shell under a USCG program, can recover oil in currents up to 8 knots. Skimmer-caused turbulence is minimized by twin floating absorbent belts on the water surface.

C-0812-78
EMULSIFYING AND DECOMPOSITION OF SPILLED OIL
Shimizu, U., and N. Taga. 1977.
Japanese Kokai (unexamined patent application) 77 75,853

Spill removal, Emulsification, Decomposition. Crude oil, Yeast, Patent, *Rice bran

"Rice bran or its mixture with yeast or yeast extracts is sprayed over spilled oil on water or seawater." In a laboratory test, the crude oil was completely emulsified after 14 days, and the residual hydrocarbon content was about half that of the control, which contained no rice bran.

[from Chemical Abstracts 88(8):#54805b. 1978]

C-0813-78
OIL SPILL: DECISIONS FOR DEBRIS DISPOSAL. VOLUME 1. PROCEDURES MANUAL
Stearns, R.P., D.E. Ross, and R. Morrison. 1977.
Report EPA/600/2-77/153a, Contract EPA-68-03-2200. 117p. Final report Jun 75-Aug 76.

Disposal, Manuals, Monitoring, Groundwater, Environmental effects, *Oil spill debris, *Landfills

This volume is a procedures manual for office and field decision-making. Topics addressed include site selection and preparation, method selection, implementation of three alternative disposal methods (land cultivation, burial, and sanitary landfilling), site monitoring requirements, and correctional measures for potential environmental problems.

[from Government Reports Announcements 77(26):#PB-272 832/7GA. 1977]

C-0814-78

OIL BINDER BASED ON POLYURETHANE RESIN FOAM POWDER

Steinbach, H.H., and K. Schnorrbusch. 1978.
German Offenlegungsschriften (unexamined patent application) 2,635,087

Absorbents, Spill removal, Patent, *Polyurethane resin foam

"Absorbents with improved capacity for removal of oil spills consist of powdered rigid polyurethane foam surface-treated with $R_nSi X_{(4-n)}$ (R=C≤12 alkyl, aryl; X=Cl, Br; n=1-3). Thus, N saturated at 65° with 66:34 $MeSiCl_3$-Me_2SiCl_3 is passed over powdered rigid polyether-polyurethane foam to 0.4% uptake. Treating a 43% aqueous suspension of spindle oil with this foam removes 83% oil (capacity 100 g oil/5 g foam), compared with 20% (capacity 100 g oil/30 g absorbent) for vermiculite."

[from Chemical Abstracts 88(20):#141441. 1978]

C-0815-78

REMOVAL OF OIL ON WATER

Suzuki, S. 1977.
Japanese Kokai (unexamined patent application) 77,126,687

Spill removal, Absorption, Distillation, Patent, *Cement

"High-strength porous solidified cement powder is spread to absorb oil on seawater and on any surface waters. Collected oil is recovered by distillation."

[from Chemical Abstracts 88(12):#76326y. 1978]

C-0816-78

COMPOSITION AND METHOD FOR DISPERSING SPILLED PETROLEUM PRODUCTS

Tennant, D.J. 1977.
French Demande 2,330,653

Spill cleanup, Dispersants, Petroleum products, Patent

A mixture for dispersing oil spills consists of emulsifier 30-40%, solvent 40-60%, and size-reducing agent 5-10% by weight. At time of use, the mixture is diluted with seawater. The emulsifier consists of a monoester of an aliphatic carboxylic acid and a polyoxyalkylene glycol; the solvent may be phthalate, adipate or azelate; and the size-reducing agent is a monoalkyl ether of ethylene glycol or a polyoxyethylene glycol.

[from Chemical Abstracts 88(16):#110148d. 1978]

C-0817-78
AN ICE-OIL BOOM--FROM TSANG'S FOLLY TO TSANG'S BOOM
Tsang, G. 1978.
Spill Technology Newsletter 3(2):15-18.

Booms, Ice, Spill cleanup, Spill containment, Design-engineering

A prototype finned and perforated boom is described, which is currently under development for use in ice-infested waters. The boom is designed to deflect ice floes, while permitting oil slicks to pass through the boom so that the oil can be collected and removed from an ice-free zone. Field tests of the device "showed that the Tsang boom served its purpose very well and should find wide application in oil containment and recovery in ice infested waters."

C-0818-78
SPILLED OIL TREATING AGENT COMPOSITIONS
Watabe, N., M. Takai, T. Sato, and N. Sato. 1977.
Japanese Kokai (unexamined patent application) 77,101,679

Spill cleanup, Patent, *Agent

"A polyoxyethylene monoester of C_{10-22} unsaturated fatty acid is added 30-70% to polyoxyethylene monoester of C_{8-22} saturated fatty acid to obtain the agent; optionally 0.5-3% of ethylene oxide-propylene oxide block copolymer is added. ...The agent uses 1/2-1/3 the amount of conventional agent."

[from Chemical Abstracts 88(10):#65847t. 1978]

C-0819-78
POLYMERIC AND CELLULOSIC FIBER MATERIAL FOR REMOVING OIL FROM WATER
Wiegand, D.E., F.H. Riedel, and O.R. Videen. 1978.
US Patent 4,070,287

Spill removal, Absorption. Patent, *Fiber material

Polyethylene fibers blended with cellulosic fibers are bonded in a web or retained by a fine mesh netlike enclosure. The material absorbs petroleum and petroleum products on water. Results indicate the matlike construction absorbed more oil than did a corresponding structure containing polyethylene fibers without cellulosic fibers and with no deleterious effects on buoyancy.

[from Chemical Abstracts 88(20):#141440x. 1978]

3. OIL TRANSFER AND TRANSPORT

C-0820-78
SAFER SHIPS: YES OR NO?
Anon. 1978.
Ocean Reporter (April-May):20-21.

Tankers, Pollution prevention, Safety, *Double bottoms

The arguments for and against the installation of double bottoms in oil tankers are briefly presented.

C-0821-78
"WILLFUL AND INTENTIONAL POLLUTION" - SOLVING THE BIG PROBLEM
Anon. 1978.
Ocean Reporter (April-May):9-10.

Tankers, Crude oil washing, Pollution prevention, Oil discharges, IMCO, *Load-on-top

This article discusses the advantages and disadvantages of the load-on-top and crude oil washing systems in oil tankers. Also dealt with are IMCO standards relating to deliberate tanker discharges at sea.

C-0822-78
REGIME FOR THE OCEAN, OUTER SPACE, AND WEATHER
Brown, S., N.W. Cornell, L.L. Fabian, and E.B. Weiss. 1977.
Washington, D.C., Brookings Institution, 1977. xi + 257 p.

Oceans, Resource management, IMCO, Tankers, Regulations, Torrey Canyon

This book examines the problems associated with the management of the ocean, outer space, and weather and climate systems--areas of international domain. Chapter 3, entitled "The Management of Navigation," deals in part with the problems of oil pollution in the sea and the role of IMCO in handling these problems.

C-0823-78
INSTALLATION, TEST AND EVALUATION OF THE DESTATOR. A DEVICE TO ENHANCE THE OPERATIONAL SAFETY AND PERFORMANCE OF BULK PETROLEUM CARRIERS
Cierva Electrooptical Corporation. 1976.
Maritime Administration, Contract MA-4-37065. 245 p. Final report. (NTIS No. PB-263 166/1ST)

Tankers, Safety, Pollution prevention, Equipment, Design-engineering, *Destator device

A device for increasing tanker safety, the Destator, has been tested and the results are presented. "Described are the test program formulation, the intrinsic safety certification program, the equipment description and the installation. Also presented are the at-sea test descriptions and results in both a clean gas-free as well as dirty-inerted environment."

[from Supertankers and Superports, Report NTIS/PS-77-0700:11. 1977]

C-0824-78
TANKER POLLUTION: AN *OCEAN WORLD* SPECIAL REPORT
Keith, R.C. (ed.) 1978.
Ocean Reporter (April-May):23 p. (Special issue)

Tankers, *Amoco Cadiz* spill, IMCO, International conventions, Segregated ballast, Pollution prevention, Safety

The articles in this special issue primarily address the *Amoco Cadiz* spill (March, 1978), the 1973 IMCO Convention and its recently proposed amendments, and the measures which could be invoked to improve tanker safety including segregated ballast, double bottoms, and backup steering systems.

4. WASTE TREATMENT AND DISPOSAL METHODS

C-0825-78
SURVEY ON QUALITY OF REFINERY EFFLUENTS IN EUROPE: A COMPARISON BETWEEN 1969 AND 1974 PERFORMANCES
Anon. 1977.
The Hague, CONCAWE, 1977. 13 p.

Wastewater treatment, Refineries, Europe, Water quality, Statistics

The 1974 survey data for 112 European oil refineries are compared with those from a 1970 survey. The quality of refinery effluents does appear to have improved since 1969.

[from Fuel Abstracts and Current Titles 18(5): #77-09-07-0257. 1977]

C-0826-78
PURIFICATION OF INDUSTRIAL EFFLUENTS CONTAMINATED WITH OIL [in German]
Author unknown. 1977.
Chemie-Anlagen und Verfahren, No. 3:96.

Wastewaters, Industries, Oil-water separation, Adsorption, *Agent NT 75

A technique for the separation of non-water soluble oils from industrial effluents is described. The process utilizes the chemical adsorption agent NT 75. The paper distinguishes between physical and chemical separation.

[from Environmental Health and Pollution Control 13(1):#161. 1978]

C-0827-78
EXAMINATION OF THE WORKING OF BIOLOGICAL PONDS AT THE NOVO-GORKY PETROLEUM REFINERY [in Russian]
Abdukadyrov, D. 1977.
Neftepererabotka i Neftekhimiya (Moscow) No. 12:10-12.

Wastewater treatment, Refineries, Biological treatment, Oxidation, *Aeration

Petroleum-contaminated refinery wastewaters are treated in large capacity biological tanks that provide 10 days of retention and aeration. Sprinkler aeration was found to be ineffective, and replacement with floating disk-type mechanical surface aerators resulted in a more environmentally satisfactory effluent quality.

[from Chemical Abstracts 88(18): #125592k. 1978]

C-0828-78
TREATMENT OF OIL-EMULSIFIED WASTE WATER [in German]
Baer, E.H. 1977.
Muenchner Beitraege zur Abwasser-, Fischerei- und Flussbiologie Vol. 28 (Behandlung von Industrieabwaessern):265-271.

Wastewater treatment, Emulsions, Flotation, *Electroflotation

"The removal of oils from wastewater by electroflotation is discussed. An electroflotation achieved high rate of removal, low capital and process costs, good removal of aged oil and emulsifiers, good separation of phosphates and heavy metals, and no problems in the presence of metal and ceramic particles."

[from Chemical Abstracts 88(8):#54670d. 1978]

C-0829-78
THE TREATMENT OF WASTEWATERS POLLUTED WITH METHYLPHENYLCARBINOL AND ACETOPHENONES [English summary]
Balan, M., E. Dacin, and M. Manea. 1977.
Revista de Chimie (Bucharest) 28(7):669-673.

Wastewater treatment, Refineries, Contaminants, Recycling

Styrene and the title contaminants were recovered (35-60%) from refinery wastewater by detonation for 2 hr, and recycled. Chemical treatment of the decanted waters with $FeSO_4$ and $FeCl_3$ removed 39-68%

of the remaining organic impurities. Adsorption on active charcoal purifies the effluent to ~98%. Another method extracts the title compounds, after decantation, by CCl_4, toluene, or n-hexane with a yield of 71-96%.

[from Chemical Abstracts 88(10):#65564y. 1978]

C-0830-78
TREATMENT OF OILY WASTES--OIL RECOVERY PROGRAMS
Bauer, D. 1977.
Industrial Waste Conference, 31st, Purdue University, Lafayette, Indiana, 1976. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p. 329-337.

Waste oil treatment, Emulsions, Refining, Industries, Economics, Equipment, *Technology review

The various processes, chemical technology, and economics of breaking soluble oil emulsions, followed by heating for oil recovery, are reviewed. The technology involved is applicable to the petroleum processing industries, metalworking plants, and steel mills.

C-0831-78
INDUSTRIAL WASTE CONFERENCE, 30TH, PURDUE UNIVERSITY, LAFAYETTE, INDIANA, 6-8 MAY 1875
Bell, J.M. (ed.). 1977.
Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc., 1977. xii + 1311 p.

Wastewater treatment, Industries, *Proceedings

Papers are presented on waste treatment from various industries, including the petroleum industry. [Relevant papers are abstracted separately in this issue of OPR.]

C-0832-78
METHOD FOR THE PURIFICATION OF WASTE WATERS POLLUTED WITH LUBRICANTS [in Russian]
Blagodarnaya, L.F., E.M. Kaliniichuk, A.A. Seliverstov, and I.A. Makarov. 1977.
Khimiya i Tekhnologiya (Kiev) No. 6:21-22.

Wastewater treatment, Emulsions, Lubricating oil, pH control, Coalescence

Addition of H_2SO_4 to adjust pH to 1-2 was used to break stable aqueous emulsions of lubricating oil. The treatment releases organic acids in their salt form and coalesces oil droplets to form a continuous oil layer on the water surface.

[from Chemical Abstracts 88(16):#110007q. 1978]

C-0833-78
OILY WASTE TREATMENT WITH POLYAMINE AND INORGANIC COAGULANT
Bouwens, J.M., and A.S. Starzecki. 1977.
Canadian Patent 1,012,918

Emulsions, Wastewater treatment, *Coagulation, Flocculation, Patent, Absorption

Wastewaters with emulsified oils are first adjusted to pH 7-8, then 10 - 10,000 ppm of a cationic condensation polymer, and 10 - 10,000 ppm of an inorganic coagulant are added. The resulting flocs absorb oil droplets from the water.

[from Chemical Abstracts 88(6):#41315s. 1978]

C-0834-78
REMOVAL OF OIL FROM WASTE WATERS BY A PRESSURE FLOTATION METHOD [in Russian]
Chechel, P.S., Yu.E. Chizhaev, Yu.P. Sobyakin, V.I. Yankov, and S.A. Fishman. 1977.
Khimicheskaya Teknologiya (Kiev), (6):24-25.

Wastewater treatment, Flotation, Lubricating oil, Design-engineering, Equipment

Wastewater polluted with lubricating oil was saturated with air in a mixing and air dispersing unit. The unit consists of a porous ceramic tube, mounted within a metallic body with pipe fittings for air and water feeding. The water purification was approximately 96% effective under conditions of between 2.0 and 7.0 g/L lubricating oil content in the wastewater and 20 min retention time within the flotation cell.

[from Chemical Abstracts 88(20):#141197y. 1978]

C-0835-78
PURIFICATION OF DIRTY WATER
Creusot-Loire, S.A. 1977.
German Offenlegungsschriften (unexamined patent application) 2,718,095

Wastewater treatment, Coalescence, Emulsions, Patent, *Detergent-oil mixtures

"Wastewaters containing petroleum and high concentrations of detergents, e.g., from cleaning tankers, are treated by passage through a coalescence column with an oleophilic coating with the addition of petroleum to ensure good emulsion separation and long filter life."

[from Chemical Abstracts 88(4):#27469p. 1978]

C-0836-78
TREATING WASTEWATER CONTAINING EMULSIFIED OILS
Davidson, D.D. 1977.
US Patent 4,040,955

Wastewater treatment, Emulsions, Adsorption, Patent

"Wastewater containing emulsified oil is treated and the oil recovered by adding $Al_2(SO_4)_3$ to the wastewater to form a flow which adsorbs the oil, separating mass of the wastewater from the floc and retaining a small amount of wastewater with the floc, dissolving a substantial amount of the floc in the retained wastewater by adding H_2SO_4 so that the retained wastewater is enriched in $Al_2(SO_4)_3$ and the remaining floc is enriched in adsorbed oil (~35%), separating the floc, and adding untreated wastewater to the $Al_2(SO_4)_3$-containing retained wastewater to reform the floc, which then adsorbs oil from the wastewater."

[from Chemical Abstracts 88(12):#78680h. 1978]

C-0837-78
WASTE OIL RECOVERY AND REUSE
Ericson, W.B. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, Cleveland, 1975. p. 151-155.

Waste oil, Disposal, Recycling, Industries

The author discusses the problem of oil disposal and reviews the history of waste oil problems in the design of water and sewage treatment facilities and sludge disposal in US cities.

C-0838-78
PILOT PLANT TESTING DEVELOPS TERTIARY WASTEWATER TREATMENT FOR PETROLEUM REFINERY
Finkler, M.L., S.D. Olds, and C.S. Applegate. 1977.
Industrial Waste Conference, 31st, Purdue University, Lafayette, Indiana, 1976. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p. 26-42.

Wastewater treatment, Refineries, Filtration, Flotation, *Pilot study, *Microscreening

Pilot plant studies of the Sohio Toledo Refinery were conducted in order to define the most cost-effective method of upgrading the secondary wastewater discharges. Alternative methods evaluated were dual-media filtration, microscreening, and induced-air flotation. Dual-media filtration and induced-air flotation consistently produced acceptable effluents; microscreening did not meet the prescribed suspended solids limitations.

C-0839-78
CONVERTING OIL AND WASTE CONTAINING SLUDGE TO DRY WASTE
Fowler, L. 1977.
US Patent 4,059,666

Sludge, Absorption, Oil-water separation, Patent

Wet, oily sludges are converted to dry material by admixing petrophilic felts and fibers, to absorb the oil and to separate the water, which is permitted to drain; adding fibrous material, such as glass fibers, in order to bond the petrophilic material; draining excess water from the sludge and adding hydrophilic materials to absorb any remaining intermixed water, and sealing the external surface of the substantially dry material.

[from Chemical Abstracts 88(16):#110136y. 1978]

C-0840-78
REMOVAL OF CONTAMINANTS FROM WATER
Garber, D.C. 1977.
Canadian Patent 1,012,071

Ballast, Oil-water separation, Filtration, Gravity separation, Coalescence, Patent, *Dewaxing unit

Water contaminated with oily or waxy substances is first passed through a gravity separator for rough separation of the oil and water, then through a ceramic dewaxing unit using porous ceramic pellets which retain wax and resins. The dewaxed effluent then passes through a filtration and coalescence unit to remove residual oil droplets. The unit is suitable for the treatment of tanker ballast waters.

[from Chemical Abstracts 88(5):#41316t. 1978]

C-0841-78
NEW INDUSTRIAL TECHNIQUE FOR THE TREATMENT OF OIL-CONTAINING WASTE WATER [in German]
Guetling, W. 1977.
Muenchner Beitraege zur Abwasser-, Fischerei- und Flussbiologie
Vol. 28 (Behandlung von Industrieabwaessern):259-263.

Oil-water separation, Wastewater treatment, Ultrafiltration, *Membranes

Ultrafiltration techniques, applying cellulose acetate and polyamide membranes, were used in the separation of oils from wastewaters.

[from Chemical Abstracts 88(6):#41219p. 1978]

C-0842-78
INDUSTRIAL WASTEWATER HANDLING
Gurnham, C.F., B.A. Rose, T.K. Nedved, and W.T. Fetherston. 1976.
Handbook of Water Resources and Pollution Control.
H.W. Gehm, J.I. Bregman, and G.V. Beeland (eds.). New York, N.Y.,
Van Nostrand Reinhold Co., 1976. p. 521-592.

Wastewater treatment, Industries, Refining, Petrochemicals, Manuals

This chapter covers the following topics: principles and procedures for industrial waste management and treatment; control and treatment technologies; and wastewater characteristics and treatment practices in major industries, including the petroleum refining and petrochemicals industries.

C-0843-78
THE CLEANUP OF REFINERY EFFLUENTS
Hillborn, J.D. 1977.
Canadian Petroleum 18(4):42-44.

Wastewaters, Refineries, Pollution prevention, Oil industry, Regulations, Guidelines, Canada

Measures taken by the Canadian petroleum industry to control pollution and improve the environment are discussed. "The present discharge situation of Canadian refineries is given...and total compliance with Federal regulations and guidelines is expected by 1980."

[from Environmental Health and Pollution Control 13(1): #165. 1978]

C-0844-78
ENVIRONMENTAL CONTROL OF TAOYUN REFINERY OF CHINESE PETROLEUM CORPORATION, TAIWAN. II. PREVENTION OF WATER POLLUTION [in Chinese]
Hsiung, Y.-L. 1977.
Shih Yu T'ung Hsin Vol. 311:5-9.

Wastewater treatment, Pollution control, Refineries, Design-engineering, *Taiwan

"Pollution prevention and wastewater treatment designs were integrated into the refining process to improve water pollution control processes in Taiwan."

[from Chemical Abstracts 88(14):#94354k. 1978]

C-0845-78
PERFORMANCE CHARACTERISTICS OF WASTE WATER PURIFICATION IN PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS [in German]
Huber, L. 1977.
Muenchner Beitraege zur Abwasser-, Fischerei- und Flussbiologie Vol. 28 (Behandlung von Industrieabwaessern):247-256.

Refineries, Petrochemicals, Industries, Wastewater treatment

"The treatment of petroleum refining and petrochemical industry wastewaters by stripping, chemical oxidation, evaporation, mechanical treatment, chemical flocculation, and biological treatment is discussed."

[from Chemical Abstracts 88(12):#78503c. 1978]

C-0846-78
TREATMENT OF WASTE LIQUOR CONTAINING OILS AND NONIONIC SURFACTANTS
Itagaki, T. and T. Yojima. 1977.
Japanese Kokai (unexamined patent application) 77 75,058

Wastewater treatment, Surfactants, *Electrolysis, Patent

Oily wastewaters from metalworking plants are treated with a polyhydroxy phenol-saccharide condensate, an inorganic electrolyte is added, and the mixture is then electrolyzed to remove the oils and surfactants.

[from Chemical Abstracts 88(6):#41313q. 1978]

C-0847-78
PROPERTIES OF AMMONIA-NEUTRALIZED LOW-MOLECULAR-WEIGHT ALIPHATIC ACIDS AND THEIR EFFECT ON THE PURIFICATION OF PETROLEUM-CONTAINING WASTE WATERS [in Russian]
Kaliniichuk, E.M., and V.Yu. Shchepanyuk. 1977.
Neftepererabotka i Neftekhimiya (Kiev) Vol. 15:95-98.

Wastewater treatment, pH control, Refineries, Hydrocarbons, Contamination, *Coagulation

"C_{2-10} fatty acids, neutralized with NH_4OH, are effective deemulsifiers for the treatment of oil-contaminated wastewaters from the petroleum refining industry. These acids affect the pH of the treated water and the efficiency of conventional purification processes by coagulation with Fe salts."

[from Chemical Abstracts 88(22):#157951a. 1978]

C-0848-78
REMOVAL OF DISSOLVED ORGANICS FROM PETROCHEMICAL EFFLUENTS [in Japanese]
Kawazoe, K., Y. Suzuki, and I. Sugiyama. 1977.
Seisan Kenkyu 29(3):110-114.

Wastewater treatment, Petrochemicals, Aromatic hydrocarbons, Adsorption, *Activated carbon

"Activated C adsorption was applied for petrochemical effluents after treatment with activated sludge. Aromatic compounds were readily adsorbed but scarcely low-molecular hydrophilic substances. The adsorption treatment was suitable for wastewaters containing total organic C 10-30 ppm."

[from Chemical Abstracts 88(14):#94426k. 1978]

C-0849-78
METHOD AND APPARATUS FOR SEPARATING POLLUTANTS FROM CONTAMINATED WATER
Krugmann, H.G. 1977.
German Offenlegungsschriften (unexamined patent application) 2,617,996

Wastewater treatment, Ships, Patent, Flotation, *Electrolysis

Wastewaters from ships are treated by electrolysis and electroflotation to remove all but <15 ppm of the pollutants, including oil emulsions. The contaminants are removed as a floating scum from the top of the apparatus.

[from Chemical Abstracts 88(8):#54791u. 1978]

C-0850-78
TREATMENT OF OIL-CONTAINING WASTE WATER
Kumasawa, T., and J. Tokunaga. 1977.
Japanese Kokai (unexamined patent application) 77,119,468

Incineration, *Atomization, Wastewater, Waste oil, Patent, Absorption

Oil-containing wastewater is atomized to increase surface area of liquid drops/unit volume, then incinerated with auxiliary fuel from sources like waste machine oil and waste engine oil. The atomization procedure also increases heat absorption.

[from Chemical Abstracts 88(20):#141269y. 1978]

C-0851-78
INVESTIGATING WASTE OIL DISPOSAL BY DIRECT INCINERATION
Le Pera, M.E., and G. De Bono. 1977.
NBS Special Publication No. 488:135-149.

Waste oil, Disposal, Incineration, Fuel oil, *Stack emissions

"Disposal of waste lubricating oil by burning it in mixtures with No. 2 heating oil caused no stack emission problems." Certain waste oil-fuel oil blends did produce emission problems attributable in part to the type of atomizer used. Burners with steam-assisted atomizers should substantially lower emission problems.

[from Chemical Abstracts 88(2):#9465e. 1978]

C-0852-78
OIL SKIMMERS (product information)
[Met-Pro Systems, Inc.]. 1977.
Pollution Engineering 9(9):107.

Skimmers, Wastewater treatment, Product information

This brochure details the Series 7000 oil skimmers which are intended primarily for wastewater treatment at a sump, pit, tank, or pond. Skimmers separate from the water various oils ranging in viscosity from fuel and cutting oils to thicker Bunker C and crude oils. Contact Met-Pro Systems, Inc., P.O. Box 144, Harleysville, PA 19438.

C-0853-78
DISPOSAL OF INDUSTRIAL WASTES
Miller, P.G. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p. 77-80.

Disposal, Industries, Government agencies, Waste oil, Toxicity

An overview is given of some of the problems facing government and industry in the treatment and disposal of industrial wastes. Three identified problem areas are the need to define uniform standards for identifying toxic and hazardous wastes, to evaluate acceptable practices for treatment and disposal, and to project future requirements for control technology implementation. [possibly oil pollution related]

C-0854-78
TREATMENT OF WASTE WATER FROM MISCELLANEOUS PLANTS [English summary]
Minafuji, K. 1976.
Ebara Infiruko Jiho Vol. 66:114-118.

Wastewater treatment, Ballast, Tankers, Industries, *Review

"A review with 3 references of treatment of wastewater from power plants, railway workshops, tanker ballast, and coal screening."

[from Chemical Abstracts 88(22):#157866b. 1978]

C-0855-78
BIO-OXIDATION PROCESS REDUCES WATER USE
Mohler, E.F., Jr., and L.T. Clere. 1977.
Energy Technology Handbook. D.M. Considine (ed.). New York, McGraw-Hill, 1977. p. 9/354-9/361.

Wastewater treatment, Refineries, Reuse, Oxidation, Conservation, *Biooxidation

"The reuse-biooxidation process successfully handles refinery wastewater to reduce pollution and conserve water while maintaining a satisfactory water quality through the plant. Phenol-type compound removal was >99.9%, which is better than standard commercial processes. COD, BOD, and total organic C removal was consistently >90%, with a residual total organic C average of [8.6 kg/200,000 L] 19 lb/1,000 barrels of crude oil processed. The process removes oil and S compounds from refinery effluent water."

[from Chemical Abstracts 88(10):#65609s. 1978]

C-0856-78
REMOVAL OF OIL SLUDGES AND METAL PROCESSING EMULSIONS BY A COMPOSTING PROCESS [in German]
Moller, U.J., A. Poul, A.B. Jodehl, and S.W.E. Tagarp. 1977.
Wasser Energie Luft 69(1-2):1-3.

Sludge, Waste oil treatment, Emulsions, Soil, *Composting process

A method is described for the production of a substance that can be used as a soil improver and is made from controlled oil sludges and metal processing emulsions. All phases involved in the process are detailed including the costs.

[from Environmental Health and Pollution Control 13(1):#162. 1978]

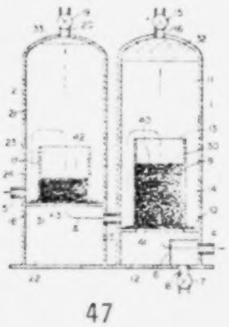
C-0857-78
CLARIFYING WASTE WATER CONTAINING FINELY DIVIDED OILY MATERIALS
Musha, M., T. Sawa, and O. Kato. 1977.
US Patent 4,059,511

Wastewater treatment, Oil-water separation, Coalescence, Patent

Oily wastewaters are passed through a succession of fibrous layers composed of hydrophilic organic polymers, arranged so that each stratum of fibers has smaller interstices than the previous stratum encountered by the effluent.

[from Chemical Abstracts 88(16):#110137z. 1978]

4,059,511
METHOD FOR CLARIFYING WASTE WATER
CONTAINING FINELY DIVIDED OILY MATERIALS
Morito Musha, Seto; Tomizo Sawa, Nagoya, and Osami Kato, Kasugai, all of Japan, assignors to Mitsubishi Rayon Co., Ltd., Tokyo, Japan
Filed June 28, 1976, Ser. No. 700,075
Int. Cl.² B01D *17/02*
U.S. Cl. 210—23 R **5 Claims**



C-0858-78
REMOVAL OF OIL FROM WASTE WATER BY ELECTROLYSIS
Nakayama, T., and T. Itagaki. 1977.
Japanese Kokai (unexamined patent application) 77 89,248

Wastewater treatment, Patent, *Electrolysis

Oily wastewaters are electrolyzed in the presence of $CaCl_2$, and the polarity of the electrodes is periodically changed. In a test, the oil content of a sample wastewater was lowered from 500 to 20 ppm.

[from Chemical Abstracts 88(8):#54777u. 1978]

C-0859-78
TREATMENT OF OIL-CONTAINING WASTE WATER
Oldham, G.F. 1977.
German Offenlegungsschriften (unexamined patent application) 2,715,164

Oil-water separation, Sludge, Gravity separation, Patent, Filtration, Wastewater treatment

Oily wastewater is passed through a closed gravity separator to yield a wet oil fraction, an oil-in-water fraction, and a wet oil sludge. The three fractions are heated to remove water, filtered to remove solids and again passed through a separator.

[from Chemical Abstracts 88(8):#54789z. 1978]

C-0860-78
OILY WASTE TREATMENT PLANT AT THE U.S. NAVY FUEL DEPOT, MANCHESTER, WASHINGTON
Primlani, I.J. 1977.
Industrial Waste Conference, 31st, Purdue University, Lafayette, Indiana, 1976. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p. 444-451.

Wastewater treatment, Flotation, Coagulation, USN, Oil terminals, Skimmers

Coagulation was used to reduce grease and oil concentrations in wastewater to <10 ppm. Air flotation and skimming were to remove the coagulated oily substances from the water surface.

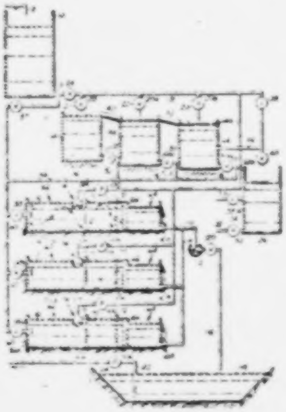
C-0861-78
OIL AND WASTE WATER RECEPTION FACILITY
Propp, C.F. 1977.
US Patent 4,048,070

Oil-water separation, Bilges, Wastewater treatment, Patent, *Decantation tanks

"Oil containing wastewater, e.g., bilge water from oil ships, is received in holding tanks and then transferred to ≥1 decantation tanks where oil floats to the top for removal. The decantation tanks can be heated and chemicals can be used in them to improve the separation. Oil-water mixture is transferred from the bottom of the decantation tanks to separator tanks which contains a skimming apparatus and a pair of baffles under which the water must pass, to further separate the oil from the water."

[from Chemical Abstracts 88(12):#78689t. 1978]

4,048,070
OIL AND WASTE WATER RECEPTION FACILITY AND PROCESS
Carl F. Propp, Rte. 2, Box 97, Estacada, Oreg. 97023
Filed June 3, 1976, Ser. No. 692,283
Int. Cl.^{2} B01D *35/00, 35/14*
U.S. Cl. 210—85 **5 Claims**



C-0862-78
EFFECTS OF OIL POLLUTION ON MUNICIPAL SEWAGE TREATMENT PLANTS
Rimkus, R.R., C. Lue-Hing, and D.T. Lordi. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p. 55-65.

Wastewater treatment, Water quality, Waste oil, *Municipal sewage

The discharge of excessive quantitites of greases, oils, and fats can cause difficulties in wastewater collection and treatment, and in receiving waters. Presented are data on hexane extractable materials, including the removal efficiency and average effluent concentrations, collected at the Metropolitan Sanitary District of Greater Chicago treatment plants.

C-0863-78
DEVELOPMENT OF A TREATMENT DESIGN FOR OILY WASTEWATER FROM TANKERS
Sadler, A.B., Jr., J.S. Pierce, Jr., and C.E. Parker. 1978.
Industrial Waste Conference, 32nd, Purdue University, Lafayette, Indiana, 1977. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1978. p. 709-715.

Wastewater treatment, Waste oil, Tankers, Oil terminals, USN, Virginia, Design-engineering

Described is a process design capable of handling highly variable oily wastewaters and treating these wastewaters to meet new oil and suspended solids limitations. The process was developed to handle oily wastewaters of the US Navy Craney Island Fuel Depot in Norfolk, Virginia.

C-0864-78
PURGING OF OIL-CONTAINING WASTE WATER
Sasagawa, K. 1977.
Japanese Kokai (unexamined patent application) 77,135,887

Wastewater treatment, Filtration, Recycling, Patent

"The wastewater was mixed with powdered coke and Fe or Fe ore; dust from a blast furnace can be also used. Thus, the wet-collected dust was precipitated, filtered, suspended in water, decanted, the precipitate added to ~20-fold amount of the wastewater for 30 min and filtered. The precipitate was heated at 800° and recycled."

[from Chemical Abstracts 88(10):#65696t. 1978]

C-0865-78
WASTEWATER-TREATMENT AGENT
Sato, H., and F. Oriya. 1977.
Japanese Kokai (unexamined patent application) 77 91,791

Wastewater treatment, Emulsions, Petroleum products, Patent

"Formed fiber is soaked in a polymer emulsion, treated with ≥1 of Fe_2O_3, $Fe(OH)_3$, and FeOOH, and dried... Wastewater (200 ml) containing 5000 ppm turbine oil was stirred with the product (1 g as Fe_2O_3) for 1 hr, which decreased the oil content to 10 ppm."

[from Chemical Abstracts 88(10):#65679q. 1978]

C-0866-78
HIGH-PRESSURE TECHNIQUES WITH POROUS GLASS MEMBRANES
Schnabel, R., and W. Vaulont. 1978.
Desalination 24(1-2-3):249-272.

Wastewater treatment, Ultrafiltration, Oil-water separation,
Industries, *Porous glass membrane

Porous glass membranes for use in reverse osmosis and ultrafiltration processes were modified to overcome problems of decreased mechanical stability and compaction. The membranes have numerous applications due to their variability in pore size, surface polarity and geometry. "Membrane separation processes in the high pressure range allow the 1-pass desalination of seawater and brackish water to drinking water and the treatment of oily industrial waste waters to concentrate the oil and reuse the water."

[from Chemical Abstracts 88(20):#141406r. 1978]

C-0867-78
ENVIRONMENT PROTECTION ON BOARD SHIP. IV. [in German]
Seibel, D. 1976.
Seewirtschaft 8(12):718-721.

Wastewater treatment, Oil-water separation, Flotation, Filtration,
Incineration, Ships

The last chapter discusses the treatment of oil and water mixtures. "Oil-water mixtures can be treated mechanically (flotation, filtering), chemically, physically or biologically; the mixture can also be incinerated."

[from Environmental Health and Pollution Control 13(4):#776. 1978]

C-0868-78
OIL ELIMINATION FROM LOADED WATERS [in German]
Seidel, K. 1977.
Naturwissenschaften 64(9):487-488.

Wastewater treatment, Sludge, Adsorption, *Sand-oil binder layer

"A transportable basin with a surface covered with a sand-oil binder layer was used in treatment of wastewater containing oil or oil-bearing sludge. The oil is adsorbed and the suspended matter is retained by the layers. The effluent is odorless and clear."

[from Chemical Abstracts 88(2):#11466z. 1978]

C-0869-78
WASTE SOLUTION TREATING APPARATUS
Shinozaki, M., and T. Matsumoto. 1977.
Japanese Kokai (unexamined patent application) 77,120,274

Wastewater treatment, Design-engineering, Patent, *Fiber aggregates

The apparatus contains fiber aggregates, from which plugging materials are removed readily by back washing. The treater consists of two chambers and ≥1 selfadhered, porous, hollow-fiber aggregates, made of crystalline polypropylene and polyolefin. "The apparatus is especially useful for removing solids and oils from wastewaters."

[from Chemical Abstracts 88(22):#158018p. 1978]

C-0870-78
STUDY OF ABSORPTION CAPACITY OF POLYURETHANE FOAM [in Russian]
Skripkin, O.N., A.Kh. Imanov, and R.I. Faleeva. 1977.
Neftepererabotka i Neftekhimiya (Moscow) No. 9:46.

Petroleum products, Sorbents, Wastewater treatment, *Polyurethane foam

"An equation is given for determining the adsorption capacity of polyurethane foam. The foam can be used in the preliminary purification of petroleum products-containing wastewaters, up to the onset of biological purification."

[from Chemical Abstracts 88(4):#27382e. 1978]

C-0871-78
ENHANCEMENT OF OIL REFINERY ACTIVATED SLUDGE BY ADDITION OF POWDERED ACTIVATED CARBON
Stenstrom, M.K., and C.G. Grieves. 1978.
Industrial Waste Conference, 32nd, Purdue University, Lafayette, Indiana, 1977. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1978. p. 196-205.

Activated sludge, Refineries, Oil industry, *Activated carbon, *Effluent quality

As part of the effort to develop, construct,and operate best available technology (BAT) waste treatment plants by 1983, powdered activated carbon was tested as a way of enhancing the activated sludge process. Data collected in this study "generally met, and occasionally exceeded the target effluent quality of 15 mg/L TOC, 24 mg/L COD, 6.3 mg/L ammonia, and 0.02 mg/L phenolics." In addition, the process is simpler to operate and more economical than the add-on granular activated carbon column process.

C-0872-78
ASSESSMENT IN INDUSTRIAL HAZARDOUS WASTE MANAGEMENT PETROLEUM RE-REFINING INDUSTRY
Swain, J.W. 1977.
Report EPA/SW-144c. 162 p. Final report Jan-Nov 76.

Aromatic hydrocarbons, Carcinogens, Disposal, Waste oil, Lubricating oil, Refining, Reclamation

The re-refining of waste oils for use as lubricants and fuel produces wastes that contain phenols and potentially carcinogenic aromatic hydrocarbons. The report reviews industry characteristics, quantity and character of its hazardous wastes, treatment and disposal technology, and cost analysis.

[from Government Reports Announcements 77(25):#PB-272 267/6GA. 1977]

C-0873-78
ENVIRONMENTAL CONSIDERATIONS IN WASTE DISPOSAL FROM DRILLING IN THE SHALLOW BEAUFORT SEA
Swanston, H.W., and H.R. Heffler. 1977.
Journal of Canadian Petroleum Technology 16(3):116-122.

Wastewaters, Disposal, Offshore drilling, Environmental effects, Beaufort Sea, *Drilling mud

"Drilling (by Imperial Oil Co.) employs a suitable mud formula which after dilution and pH adjustments is discharged into local water without any serious environmental consequences."

[from Chemical Abstracts 88(18):#126004q. 1978]

C-0874-78
TREATMENT OF WASTE CLAY CONTAINING OIL
Taka, S. and H. Yokouchi. 1977.
Japanese Kokai (unexamined patent application) 77,124,005

Lubricating oil, Oil-water separation, *Oil removal, Waste oil treatment, Patent

"Oil-containing waste clay from the purification of mineral oils is mixed with water 40-60, cement 1-5, and optionally a flocculant 0.01-0.1% and gelled. Oil and water are separated from the gelled mass by a suitable method." Using this method, 0.17 L lubricating oil was recovered from 1 kg waste clay.

[from Chemical Abstracts 88(22):#155613t. 1978]

C-0875-78

TREATMENT OF WASTE WATER CONTAINING EMULSIFIED OIL
Tanaka, M. 1977.
Japanese Kokai (unexamined patent application) 77,124,473

Wastewater treatment, Emulsions, Flocculation, Patent, Flotation

"Wastewater containing emulsified oil is mixed 1st with an acidic flocculant and then with a solution from electrolysis of an alkaline flocculant or alkali substance solution, and floated to remove oil with scum."

[from Chemical Abstracts 88(20):#141271t. 1978]

C-0876-78

DETERMINING THE EFFECT OF PETROLEUM HYDROCARBONS ON AQUEOUS ENVIRONMENTS
Tischler, L.F., R.L. Elton III, and D.L. Ford. 1977.
Industrial Wastes (Chicago) 23(6):20-24.

Wastewater treatment, Sampling, Hydrocarbons, Oil-water separation

The precision of various test methods for determining amounts of oil and grease in wastewaters is compared. The Freon-extraction-IR method yielded 20% higher values than those obtained by the Freon-extraction-gravimetric method. Also discussed was oil removal from wastewater by separators, gravity separation, dissolved air flotation, flocculation and sedimentation, filtration membrane processes, and C adsorption.

[from Chemical Abstracts 88(22):#158002d. 1978]

C-0877-78

INPUT AND FATE OF PETROLEUM HYDROCARBONS ENTERING THE PROVIDENCE RIVER AND UPPER NARRAGANSETT BAY FROM WASTEWATER EFFLUENTS
Van Vleet, E.S., and J.G. Quinn. 1977.
Environmental Science & Technology 11(12):1086-1092.

Wastewaters, Hydrocarbons, Fate, Sedimentation, Rivers, Estuaries, Coasts, Narragansett Bay, *Providence River

A one-year study conducted on petroleum hydrocarbons in the Providence River in Rhode Island indicated that wastewater secondary treatment plants may contribute to oil pollution in estuarine and coastal areas. Approximately half of the hydrocarbons discharged from the plant being investigated sedimented in the river and the remainder were carried to and distributed in Narragansett Bay.

[from Biological Abstracts 65(6):#36514. 1978]

C-0878-78
ELIMINATION OF LIPOPHILIC CONTAMINANTS IN WATER TREATMENT [English summary]
Weil, L., H. Berger, and K.E. Quentin. 1977.
Chemie - Ingenieur - Technik 49(5):429.

Wastewater treatment, Hydrocarbons, PAH, Contaminants, Flocculation

Organic matter and various hydrocarbons, including PAHs and aliphatic hydrocarbons were efficiently removed from wastewater with the flocculant Liposorb. Activated carbon was also useful in removing polycyclic aliphatic hydrocarbons.

[from Chemical Abstracts 88(2):#11427n. 1977]

C-0879-78
SYSTEMS APPROACH TO POLLUTION-FREE PETROLEUM
Yamaguchi, T. 1975.
World Petroleum Congress Vol. 6:271-277.

Wastewater treatment, Refineries, Solid wastes

"The waste gas, wastewater, and waste solid treatment systems and pollutant emissions from a model refinery are described and discussed."

[from Chemical Abstracts 88(22):#157632x. 1978]

5. OIL-WATER SEPARATION

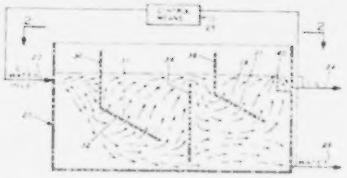
C-0880-78
APPARATUS FOR SEPARATING OIL-WATER MIXTURES
Anderson, D.K. and M.A. Stewart. 1977.
US Patent 4,064,054

Oil-water separation, Patent, Design-engineering, Equipment

"The apparatus comprises a tank with an inlet for an oil-water mixture and an outlet for the separated oil on opposite sides of the tank and above its horizontal centerline, an outlet for the separated water below the oil outlet and near the tank bottom, means for controlling the flow through the inlet and outlets to permit establishment of a desired liquid level in the tank, and baffle sections, connected across the tank."

[from Chemical Abstracts 88(12):#75702f. 1978]

4,064,054
APPARATUS FOR SEPARATING OIL-WATER MIXTURES
David K. Anderson, and Marvin A. Stewart, both of Avenal, Calif., assignors to Chevron Research Company, San Francisco, Calif.
Filed Dec. 22, 1976, Ser. No. 753,047
Int. Cl.² B01D *17/02*
U.S. Cl. 210—536 2 Claims



C-0881-78
DRINKING WATER TREATER ESPECIALLY FOR SURFACE WATER CONTAMINATED WITH TRACES OF OIL
Bischoff, A. 1977.
German Offenlegungsschriften (unexamined patent application) 2,609,343

Oil-water separation, Filtration, Contaminants, Freshwater, Patent

Oil is removed by filtration, using a filter composed of nylon and cloth layers. The filter is mounted into a vertical cylinder with an inlet and discharge pipe at the top and bottom, respectively. Water influx is controlled by a magnetic valve operated by a float which limits the flow rate to 5-6 L/minute. The filter element can be cleaned and reused.

[from Chemical Abstracts 88(16):#110349v. 1978]

C-0882-78
METHOD AND APPARATUS FOR TREATMENT OF FINELY DIVIDED SOLIDS
Cairns, R.J.R., and J.M. Howard. 1977.
German Offenlegungsschriften (unexamined patent application) 2,706,426

Oil-water separation, Filtration, Dispersants, Patent

"Oil is removed from water by passing it through a filtering bed made of anthracite, sand, or glass particles 0.1-3mm in diameter which are treated with a dispersant such as polybutenyldiethylenetriamine and polybutenyltetraethylenepentamine."

[from Chemical Abstracts 88(2):#11538z. 1978]

C-0883-78
COALESCENCE OF EMULSIFIED OILY WASTEWATER BY FIBROUS BEDS
Chieu, J.-N., E.F. Gloyna, and R.S. Schechter. 1977.
Industrial Waste Conference, 30th, Purdue University, Lafayette, Indiana, 6-8 May, 1975. Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc., 1977. p. 611-620.

Oil-water separation, Wastewater treatment, Coalescence, Refineries, *Fibrous beds

"The objective of this study was to determine the feasibility of using fibrous bed coalescers to separate emulsified oil from industrial waste streams, and to evaluate the important system parameters. Variables investigated include influent oil concentration, flow rate and bed depth."

C-0884-78
SEPARATOR FOR OIL FLOATING ON WATER
Ehrler, P., and J. Janitza. 1978.
German Offenlegungsschriften (unexamined patent application) 2,630,497

Oil-water separation, Absorption, Sorbents, Patent

"In the title process, the oil is absorbed on a revolving, elastically-compressible belt of hydrophobic, oleophilic fibers and is removed from the belt by a squeezing roll."

[from Chemical Abstracts 88(14):#94518s. 1978]

C-0885-78
HOW TO REMOVE OILS AND LUBRICANTS FROM WATER? [in German]
Enke, C. Gg. 1976.
Wasser Luft Betrieb 20(12):685-688.

Oil-water separation, Lubricating oil, Cost analysis, Biological effects

Various methods for removing small amounts of oil from water are discussed and their costs compared. The biological impacts of pollutants in water are included.

[from Environmental Health and Pollution Control 13(4):#781. 1978]

C-0886-78
OIL-WATER SEPARATOR (product information)
[Enquip, Inc.]. 1977.
Pollution Engineering 9(9):76.

Oil-water separation, Gravity separation, Spill removal, Equipment, Product information, *Enquip, Inc.

This separator works by gravity displacement in recovering oil and other hydrocarbon spills. The separation chamber and battle arrangement will accommodate varying oil-water mixtures and flow rates, and there are no adjustable or mechanically operated components. The unit meets or exceeds API criteria.

C-0887-78
EQUIPMENT TO CLEAN OIL POLLUTED WATER SURFACES [in German]
[French Society Alstohm]. 1976.
Hansa 113(23):2074.

Oil-water separation, Equipment, *Cyclonet

A description of Cyclonet, manufactured by the French Society Alstohm in Grenoble, is given. Oil-water mixtures are sieved, rotated, and the oil column in the center, formed by rotation, is pumped out.

[from Environmental Health and Pollution Control 13(4):#774. 1978]

C-0888-78
INDUSTRIAL OIL-WATER SEPARATOR (product information)
[General Electric Co.]. 1977.
Pollution Engineering 9(9):101.

Oil-water separation, Equipment, Gravity separation, Coalescence, Product information

This brochure describes equipment configuration, operation, and applications of oil/water separators which use gravity separation and coalescing action. Coalescing plate assemblies are available for installation in existing or new API-type separators at flow rates up to 10,000 gpm. Contact General Electric Co., 3198 Chestnut St., Philadelphia, PA 19101.

C-0889-78
OIL/WATER SEPARATORS MEET EPA STANDARDS (product information)
[General Electric Co.]. 1978.
Hydrocarbon Processing 57(3):226.

Oil-water separation, EPA, Coalescence, Reuse, Regulations, Product information

"Oil/water separators are designed to meet EPA standards in the separation of a spectrum of oils from oil-water mixtures of high or low concentrations at various flow rates."

C-0890-78
REMOVAL OF EMULSIFIED PETROLEUM PRODUCTS FROM WATER ON FINE GRANULAR FILTERS [in Russian]
Gorbunova, O.G., L.Z. Kiseleva, and V.D. Lisitskaya. 1977.
Vodosnabzhenie i Sanitarnaya Tekhnika No. 8:12-13.

Oil-water separation, Emulsions, Filtration, Petroleum prducts

"Emulsified petroleum products (<50mg/L) were removed from water by filtration through beds of a mixture of a particulate material (1-2mm) such as dolomite, sand, or glauconite with 10-20% of a fine-fiber additive such as asbestos or asbestos-cement wastes."

[from Chemical Abstracts 88(6):#41470p. 1978]

C-0891-78
RECOVERY PROCESSES AND APPARATUSES
Greenfield, C., R.E. Casparian, and A.J. Bonanno. 1977.
British Patent 1,477,039

Oil-water separation, Equipment, Solid wastes, Patent, *Slurries

Low-viscosity, water-immiscible oils are used to separate oily solids from aqueous slurries. The necessary equipment and procedures are described.

[from Chemical Abstracts 88(8):#54767r. 1978]

C-0892-78
OIL-WATER SEPARATION MEMBRANE
Hata, Y. 1978.
German Offenlegungsschriften (unexamined patent application) 2,741,486

Oil-water separation, Hydrocarbons, Aromatic hydrocarbons, Patent, *Membranes

"Acrylonitrile (I) was copolymerized with maleic anhydride (II), acrylic acid, or an alkyl acrylate and acrylic acid, and the copolymers were used as membranes for the separation of water from C_6H_6, kerosine, hexane, $CHCl_3$, CCl_4, light petroleum, etc."

[from Chemical Abstracts 88(22):#153563c. 1978]

C-0893-78
LIQUID-LIQUID SEPARATION
Hatanaka, T. 1977.
Japanese Patent 77 32,358

Oil-water separation, Wastewater treatment, Filtration, Flotation, Flocculation, Patent

A method useful in removing oils from wastewater is described. The liquid-liquid suspension is first filtered to remove solids, then separated by flotation after flocculation and agglomeration of the oil.

[from Chemical Abstracts 88(18):#126024w. 1978]

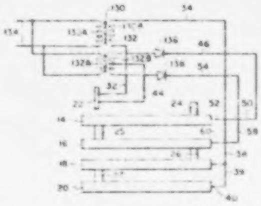
C-0894-78
DUAL FIELD ELECTRIC TREATER
Hodgson, R.A. 1977.
US Patent 4,056,451

Oil-water separation, Equipment, Design-engineering, Emulsions, Patent, *Electric treatment

Oil field emulsions are separated into water and oil phases by passage through a series of trays supplied with a.c. and d.c. potentials applied to electrodes.

[from Chemical Abstracts 88(4):#25442a. 1978]

4,056,451
DUAL FIELD ELECTRIC TREATER
Robert A. Hodgson, Tulsa, Okla., assignor to Maloney-Crawford Tank Corporation, Tulsa, Okla.
Filed Mar. 29, 1976, Ser. No. 671,090
Int. Cl.^{2} C10G *33/02*
U.S. Cl. 204—305 **7 Claims**



C-0895-78
SEPARATION OF OIL AND WATER
Hoketsu, H. 1977.
Japanese Kokai (unexamined patent application) 77 86,988

Oil-water separation, Patent, Sorbents, *Plastics

"A mixture of granular plastics and foamed plastics is added to oil on water and stirred; the plastics collect the oil and form balls."

[from Chemical Abstracts 88(10):#65832j. 1978]

C-0896-78
UNIQUE CONCEPT IN OIL/WATER SEPARATION (product information)
[Hyde Products, Inc.]. 1978.
Hydrocarbon Processing 57(4):328.

Oil-water separation, Gravity separation, Monitoring, Product information

A new oil-water separator is described which separates oil droplets to less than 20μ by gravity flow through a non-plugging medium. The Hyde Oil Content Monitor is also described which uses UV fluorescence to monitor oil content.

C-0897-78
OIL SEPARATION FROM CONTAMINATED SEAWATER
Kushihata, H., and H. Yokohama. 1977.
Japanese Kokai (unexamined patent application) 77 26,516

Oil-water separation, Bilges, Wastewaters, Seawater, Adsorption, Filtration, Equipment, Patent

Oily bilges or wastewaters are treated in an apparatus which separates oil and sulfur-containing solids. The apparatus has a coarse oil droplet separator with vertical inverted conical baffles, filters containing Polypro ES 300, a precipitation tank, and zigzag-type adsorption filters containing Polypro ES 300 and an oil adsorbent.

[from Chemical Abstracts 88(8):#54769t. 1978]

C-0898-78
APPARATUS AND METHOD FOR TREATING AN EMULSION
Middlebeek, C.G. 1976.
Netherlands Application 75 07,281

Oil-water separation, Emulsions, Equipment, Patent

Oil-in-water emulsions are broken by passing the emulsion along a wall with flow channels, "taking advantage of the phenomenon that the difference between the adhesion of the wall to the emulsified oil and the cohesion of the emulsified oil is greater than the difference between the adhesion of the wall to the carrier fluid and the cohesion of the carrier fluid."

[from Chemical Abstracts 88(14):#91660w. 1977]

C-0899-78
RECOVERY OF OIL FROM MUDDY WASTE OIL
Nishino, T., M. Yanase, and T. Ichino. 1977.
Japanese Kokai (unexamined patent application) 77,114,601

Oil-water separation, Waste oil, Oil tanks, Tankers, Patent, *Waste clay

"Muddy waste oil from the bottom of oil tanks or tanker is mixed with 3-10% waste clay, passed through diatomaceous earth layers to remove solid materials, and treated in a water-oil separator to recover oil. The addition of waste clay improves the hue of the recovered oil, and decreases the S content."

[from Chemical Abstracts 88(12):#76354f. 1978]

C-0900-78
OIL SEPARATION AND RECOVERY (product information)
[Oil Recovery Systems, Inc.]. 1977.
Pollution Engineering 9(9):109.

Oil-water separation, Spill removal, Product information, *Oil Recovery Systems, Inc.

This bulletin "announces an oil recovery system which is completely selective and delivers a 99+ percent water-free product at rates above 5 gpm." Also detailed is a surface sampler which slices through a surface slick and collects a sample for measuring the thickness of the layer. Contact Oil Recovery Systems, Inc., Main Street, Greenville, NH 03048.

C-0901-78
SEPARATION OF INDUSTRIAL OIL-IN-WATER EMULSIONS UNDER THE EFFECT OF ACIDS AND TEMPERATURE
Pohl, K.M. 1977.
Muenchner Beitraege zur Abwasser-, Fischerei- und Flussbiologie Vol. 28 (Behandlung von Industrieabwaessern):273-276.

Oil-water separation, Emulsions, pH control, Filtration

Using the Scholler process, the emulsion is preheated to 90°±5°, adjusted to pH 1.5-2 with H_2SO_4, and passed through quartz filter bed(s) to separate the oil and other substances.

[from Chemical Abstracts 88(6):#41220g. 1978]

C-0902-78
APPARATUS FOR SEPARATING LIGHT LIQUIDS FROM WASTE WATERS
Purator Klaeranlagen. 1977.
Austrian Patent 338,710

Oil-water separation, Wastewaters, Patent, Design-engineering, Filtration

A filtration apparatus is described which consists of a vertical tank with ≥ 1 removable cylindrical filter cartridge(s). Liquid is pumped in through the bottom and passes upward through the filters to an outlet at the top.

[from Chemical Abstracts 88(4):#27461e. 1978]

C-0903-78
APPARATUS FOR THE SEPARATION AND RECOVERY OF INSOLUBLE HYDROCARBONS FROM WATER
Reinhard, E. 1977.
German Offenlegungsschriften (unexamined patent application) 2,627,598

Oil-water separation, Hydrocarbons, Equipment, Patent

"The title apparatus consists of a receiving chamber separated from a central chamber by a baffle, the central chamber containing a barrier of hard fibrous material placed obliquely between the inlet and outlet."

[from Chemical Abstracts 88(4):#27472j. 1978]

C-0904-78
DEGREASER-DEOILER SEPARATOR APPARATUS
Rossi, E.C. 1977.
French Demande 2,337,572

Oil-water separation, Design-engineering, Patent, Sludge

An apparatus is described for removing grease or oil scum from water. "Air is passed into the base of the main vessel. The liquid to be deoiled passes into the vessel under the siphons. Sludge falls to the base and oil floats to the top to be removed by the scraper."

[from Chemical Abstracts 88(22):#154880r. 1978]

C-0905-78
FIBROUS OIL-ADSORBENT
Sato, H., and F. Oriya. 1977.
Japanese Kokai (unexamined patent application) 77,127,488

Oil-water separation, Adsorption, Sorbents, Patent

"At least one of foamed polymers and copolymers of polyethylene, polypropylene and polyisobutylene of average foam wall-thickness $<100\mu$ holds MgO or $Mg(OH)_2$ in a (50-80):(20-50) ratio. It adsorbs oil in water at ppm concentration."

[from Chemical Abstracts 88(14):#94499m. 1978]

C-0906-78
WATER TREATING AGENT
Sato, H., and F.Oriya. 1977.
Japanese Kokai (unexamined patent application) 77,104,488

Oil-water separation, Lubricating oil, Adsorption, Patent

Turbine lubricating oil was removed from water by mixing yellow Fe oxide with formaldehyde-urea resin (1:1 ratio) and an amine dried at 80°, crushed, and used as adsorbents.

[from Chemical Abstracts 88(2):#11542w. 1978]

C-0907-78
OIL ADSORBENT FOR REMOVAL OF OIL FROM WASTE WATER
Sato, H., and F. Itani. 1977.
Japanese Kokai (unexamined patent application) 77 89,244

Oil-water separation, Wastewaters, Adsorption, Patent, *Sorbent gauze

Fibrous material, such as cotton gauze, is impregnated with an ethylene vinyl acetate copolymer latex emulsion, MgO or $Mg(OH)_2$ is added to the surface, and the material is dried.

[from Chemical Abstracts 88(8):#54778v. 1978]

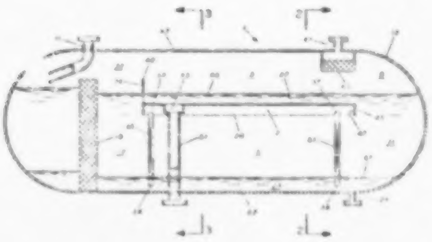
C-0908-78
LIQUID SEPARATION APPARATUS AND METHODS
Strahorn, D.F., and R.F. Goldstein. 1977.
US Patent 4,059,517

Oil-water separation, Design-engineering, Gravity separation, Patent, Equipment

An apparatus design is described which separates floating oil from water by gravity. The apparatus uses a horizontal baffle with a sloping, inverted-V shaped channel to permit the mixed lighter and heavier liquids to separate into two phases, which then drain into separate vessels.

[from Chemical Abstracts 88(4):#24616y. 1978]

4,059,517
LIQUID SEPARATION APPARATUS AND METHOD
David F. Strahorn, and Roger F. Goldstein, both of Oakland, Calif., assignors to Chevron Research Company, San Francisco, Calif.
Filed Sept. 13, 1976, Ser. No. 722,972
Int. Cl.^{2} B01D *17/00*
U.S. Cl. 210—73 R **15 Claims**



C-0909-78
OIL-WATER SEPARATION APPARATUS
Sueki, Y., and G. Kameta. 1977.
Japanese Kokai (unexamined patent application) 77 81,073

Oil-water separation, Equipment, Gravity separation, Wastewaters, Adsorption, Patent

Oil is separated from wastewater by an apparatus which consists of, in the sequence of use, a precipitation tank, an oil-water separation tank, and several interconnected oil adsorption tanks.

[from Chemical Abstracts 88(8):#54807d. 1978]

6. RECLAMATION AND REUSE

C-0910-78
DON'T DUMP THAT OIL. RECYCLE IT (news brief)
Anon. 1978.
Science News 114(2):28.

Waste oil, Reclamation, Recycling, Pollution control

EPA statistics indicate that as much as 50,000 barrels of oil per day could be saved if all waste oil was recycled. According to an article in the April 1978 Conservation News, over 20 states are examining the possibility of statewide used oil recycling centers.

C-0911-78
ILLINOIS STATE WASTE OIL OUTLOOK
Bahr, E.W., and J.E. Dunwoody. 1978.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p. 115-135.

Waste oil, Legislation, Illinois, Resource management, *Proceedings

The Office of the Illinois Energy Coordinator thinks the federal government has not developed the potential to make greater use of waste oil. They have, therefore, prepared a legislative proposal for the state of Illinois, which is presented and outlined in this paper. The legislation would establish product standards and remove labelling requirements in an effort to induce consumer acceptance.

C-0912-78
MEASUREMENTS AND STANDARDS FOR RECYCLED OIL: PROCEEDINGS OF A WORKSHOP HELD AT THE NATIONAL BUREAU OF STANDARDS IN GAITHERSBURG, MARYLAND ON NOVEMBER 22 AND 23, 1976
Becker, D.A. 1977.
Report NBS-SP-488. 145p. Final report.

Waste oil, Crankcase oil, Recycling, Reuse, Industries, Legislation, *Proceedings

Coverage includes the NBS recycled oil program, incineration, automotive crankcase drainings reuse, industrial oil recycling, activities of the ASTM and the API used oil task forces, recent used oil legislation, factors affecting used oil recovery/utilization and effects of proposed policy alternatives, and marketing barriers for recycled oil.

[from Government Reports Announcements 77(24):#PB-271 562/1GA. 1977]

C-0913-78
RESULTS OF USED OIL RECYCLING IN THE GERMAN DEMOCRATIC REPUBLIC
Hartmann, A., O. Pucher, H. Schulze, A. Menzel, and M. Goertz. 1977.
Schmierungstechnik 8(11):368-371.

Reclamation, Recycling, Lubricating oil, Solvents

"Extraction of used lubricating oils with liquid C_3H_8, addition of solvent extracts, and extraction with PhOH gave oils with better lubricant, aging, and engine characteristics than fresh oils of the same origin."

[from Chemical Abstracts 88(14):#91885y. 1978]

C-0914-78
MANAGEMENT OF ENVIRONMENTAL RISK: A LIMITED INTEGRATED ASSESSMENT OF THE WASTE OIL REREFINING INDUSTRY
Liroff, S.D. 1978.
Berkeley, California, Teknekron, Inc., 1978. xxiv + 252p. (Final report. Prepared for the National Science Foundation)

Waste oil, Refining, Recycling, Disposal, Environmental management, Economics, Oil industry

This report is the result of a workshop held in Berkeley, California, September 1977, which assessed the current state of the US waste oil rerefining industry. Five topic areas critical to the industry and useful to environmental policymaking were examined. These five areas include (I) An Inventory Assessment of Several Rerefining Technologies, (II) A Financial Analysis of Several Rerefining Technologies, (III) An Analysis of Alternative Futures of the Rerefining Industry, (IV) The Disposal of Acid Sludge, and (V) State and Local Governments as a Future Market for Rerefined Waste Oil. Potential impacts of recent legislation and the potential of establishing recycled oil programs in the US are evaluated.

C-0915-78
HOW ENVIRONMENTAL AGENCIES AND INDUSTRY CAN SOLVE PROBLEMS WORKING TOGETHER
Swain, J.W., Jr. 1975.
International Conference on Waste Oil Recovery and Reuse, 2nd, Cleveland, 1975. p. 101-105.

Recycling, Waste oil, Industries, Government agencies

The author discusses the need to develop a three-way cooperative relationship between government, the oil using industry, and the oil producing industry in the area of oil recycling.

C-0916-78
SOLID FUEL FROM WASTE OIL
Tsumura, S. 1977.
Japanese Kokai (unexamined patent application) 77,101,201

Waste oil treatment, *Solid fuel, Patent, Reuse

"Waste oil is kneaded with suitably cut combustible rubbish to a rice-cake form, pressed to remove water, and dried to obtain a solid fuel." [possibly oil pollution related]

[from Chemical Abstracts 88(22):#155651d. 1978]

C-0917-78
WAYS THE DEPARTMENT OF DEFENSE CAN IMPROVE OIL RECYCLING
US General Accounting Office, Logistics and Communications Division. 1977.
Report LCD-77-307. 44p. Report to the Congress.

Recycling, Waste oil, Lubricating oil, Resource management, Government agencies, US, Legislation

This review evaluates Federal agencies' progress toward meeting the oil recycling requirements of the Energy Policy and Conservation Act of 1975. Disposal of used lubricating oil, improved oil recycling, and specific resource management requirements are discussed.

[from Government Reports Announcements 77(26):#PB-272 407/8GA. 1977]

C-0918-78
REFINING OF WASTE OIL
Ukita, K. 1977.
Japanese Kokai (unexamined patent application) 77 62,309

Waste oil, Reclamation, Refining, Patent

"Waste oils are dewatered, mixed with an organic polymer and concentrated H_2SO_4, and settled to remove coagulated material."

[from Chemical Abstracts 88(8):#52832j. 1978]

C-0919-78
RECOVERY OF WASTE OIL
Vacsol Corporation. 1977.
German Offenlegungsschriften (unexamined patent application) 2,725,132

Waste oil treatment, Crankcase oil, Patent, Extraction, Reclamation

"Waste crankcase oil is recovered by removal of water at 107°, vacuum fractionation, extraction with $PhNO_2$, and steam stripping."

[from Chemical Abstracts 88(20):#139111x. 1978]

7. PERSONNEL TRAINING AND EDUCATION

C-0920-78
HOW TO DEAL WITH OIL SPILLS (product information)
Anon. 1978.
Marine Pollution Bulletin 9(1):4.

Personnel training, API, Manuals, Statistics, Oil spills

API has published a handbook, "Oil spill studies, strategies and techniques, API Publication No. 4268." Included are sections on oil chemistry, plankton, benthos, marine vertebrates, and advice on the collection and statistical handling of evidence for legal purposes. The handbook is available from API, 2101 L St. NW, Washington, DC 20037.

C-0921-78
NAUTICAL EDUCATION FOR THE OFFSHORE EXTRACTIVE INDUSTRIES - TRANSPORTATION
Hoffman, G.H., F. Townsend, and W. Norville. 1977.
Report LSU-B-77-001, NOAA-77092122. 214p.

Personnel training, Platforms, Tankers, Ships, Oil transport, Safety, Manuals, Design-engineering

"This publication presents details on the petromarine fleet involving the design and construction of tankers, barges, drill ships, crew boats, supply vessels, tugs, derrick barges, pipelaying barges, and air cushion vehicles." [possibly oil pollution related]

[from Government Reports Announcements 77(26):#PB-273 044/8GA. 1977]

8. CONTINGENCY PLANNING

C-0922-78
FAST DECISIONS IN SHIP ACCIDENTS
Anon. 1977.
Canadian Shipping and Marine Engineering 48(9):52.

Contingency planning, Tankers, Oil spills, Environmental protection, Safety

A software system marketed under the name The Kockums T-90 was recently developed. The program is designed to immediately assess and decide on the best and safest course of action when ship accidents occur.

[from Aquatic Sciences and Fisheries Abstracts Part 1 8(1):#816-1Q8. 1978]

C-0923-78
RESPONSE TO SPILLS IN ONTARIO
Belling, P.C. 1978.
Spill Technology Newsletter 3(2):32-36.

Contingency planning, Spill cleanup, Government agencies, Legislation, Canada, *Ontario

This article identifies the various contingency plans, spill response programs, and jurisdictions of Ontario's municipal and provincial government bodies, and indicates the levels of escalating response available for spills of different magnitude or impact.

C-0924-78
NEWS AND COMMENT: NATURE CONSERVANCY COUNCIL'S THIRD ANNUAL REPORT (news brief)
Conder, P., and M. Everett. 1978.
British Birds 71(3):141.

Contingency planning, Coasts, Wildlife, *British Isles

A brief summary of the title report is given. The report included revised recommendations for treatment of the coastline of the British Isles in the event of oil pollution.

9. PREVENTION AND CONTROL MEASURES

C-0925-78
OIL SPILL PREVENTION AND RECOVERY (product information)
Anon. 1977.
Pollution Monitoring No. 37:39.

Product information, Monitoring, Bilges, Ballast, Spill removal, Pollution prevention

Briefly described are three systems for oil spill prevention and recovery. The Oili oil content meter is used for continuous monitoring of oil in bilge and ballast water. A range of machines are described which can recover animal, mineral, or vegetable oil with a maximum water content of 15%. Finally, a compact container is designed for carrying all the necessary oil pollution control equipment.

[from Applied Ecology Abstracts 4(2):#2044-D4. 1978]

C-0926-78
ROUND-THE-WORLD NEWS: HONG KONG (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(5):117-118.

Pollution prevention, Oil spills, Contingency planning, *Hong Kong

"A series of anti-pollution measures have been taken by the Hong Kong government to combat oil spills which, during 1977, totalled almost 40."

C-0927-78
LUBRICATION WITHOUT POLLUTION (product information)
Author unknown. 1977.
Marine Engineers Review, June:25.

Ships, Pollution prevention, Product information, *Lubrication, *Sealing systems

A new propeller shaft sealing system designed to reduce pollution risk and prolong the life of seals is described. "The new Glacier-Pilgrim Coastguard Sterngear System was jointly developed by the Glacier Metal Company Limited, Deep Sea Seals Limited, and Pilgrim Engineering Development Limited."

[from Environmental Health and Pollution Control 13(5):#992. 1978]

C-0928-78
DECISIONS FOR DELAWARE. SEA GRANT LOOKS AT OIL SPILLS
Biggs, R.B. 1977.
Report DEL-SG-13-77, NOAA-77090106. 35p.

Oil transfer, Oil spills, Pollution control, Contingency planning, Environmental effects, Delaware Bay

A hypothetical spill occurring at the lightering area in the low Delaware Bay is evaluated. Potential environmental effects are diverse. Policies, procedures, and jurisdictions for the prevention, control, and cleanup of spills in this area are numerous and overlapping.

[from Government Reports Announcements 77(25):#PB-272 673/5GA. 1977]

C-0929-78
OFFSHORE DRILLING TECHNOLOGY
Carmichael, F.R. 1975.
Park Ridge, New Jersey, Noyes Data Corporation, 1975. 392p.

Pollution prevention, Offshore drilling, Platforms, Patent, Equipment

This book provides detailed technical information on offshore drilling techniques and equipment, based on US patents issued since 1967. The section on drilling platforms includes a review of a patent for containment of oil spillage on the deck of a platform [R.V. Phelps, US Patent 3,657,895. 1972].

C-0930-78
SAFETY SYSTEMS IN THE PETROLEUM INDUSTRIES [English summary]
Egi, N. 1976.
Sekiyu Gakkai Shi 19(12):1051-1056.

Pollution prevention, Oil industry, Safety

"Safety, prevention of serious accidents, and the prevention of environmental pollution are discussed."

[from Chemical Abstracts 88(10):#65236t. 1978]

C-0931-78
ATLANTIC OFFSHORE USERS WORKSHOP HELD AT UNIVERSITY OF DELAWARE, NEWARK, DELAWARE ON MAY 19-21, 1977
Gaither, W.S. 1977.
Report DEL-SG-11-77, NOAA-77091502. 294p.

Offshore drilling, OCS, Resource management, Disposal, Models, Pollution prevention, Atlantic Coast, *Workshop

Commercial users of the Atlantic offshore areas, governmental regulators and service organizations, and Sea Grant institutional representatives met to identify the most important oceanographic and related engineering problems or information gaps. Presented in order of priority are 83 problems which, if solved, could contribute to better commercial use and resource management.

[from Government Reports Announcements 77(26):#PB-273 061/2GA. 1977]

C-0932-78
HANDBOOK OF WATER RESOURCES AND POLLUTION CONTROL
Gehm, H.W., J.I. Bregman, and G.V. Beeland (eds.). 1976.
New York, N.Y., Van Nostrand Reinhold Co., 1976. 840p.

Pollution control, Wastewater treatment, Refining, US, Legislation

This book addresses two main topic areas: water supply and its use for human and industrial needs; and wastewater, its treatment and reuse. Chapter 13, entitled "Industrial Wastewater Handling," by C.F. Gurnham, et al., covers wastewater treatment in the oil refining industry. Chapter 19, entitled "The Water Pollution Control Act (As Amended in 1972, P.L. 92-500)," by J.I. Bregman, et al., discusses the Act on an item-by-item basis. [The chapters are abstracted separately in this issue of OPR.]

C-0933-78
DEVELOPING A DISPERSANT SPRAYING CAPABILITY
Gill, S.D. 1978.
Spill Technology Newsletter 3(1):33-38.

Pollution control, Dispersants, Equipment, Spill cleanup, Canada, *Dispersant technology

This article reviews, with numerous illustrations, the Canadian Coast Guard's programs for keeping abreast of recent improvements in oil spill dispersant technology so that the most widely applicable countermeasures equipment and methods can be deployed during spill emergencies.

C-0934-78
STATIC ELECTRIFICATION IN SUPERTANKERS
Makin, B. 1975.
Physical Technology 6(3):109-116.

Tankers, Pollution prevention, Safety, *Static electricity

The causes of static electricity aboard supertankers which can result in disastrous explosions are examined and their means of prevention are discussed.

[from Supertankers and Superports, Report NTIS/PS-77/0701:44. 1977]

C-0935-78
ACOUSTIC EMISSION MONITOR DETECTS LEAKS (product information)
[Rockwell International]. 1978.
Hydrocarbon Processing 57(5):327.

Equipment, Product information, Monitoring, Leakage, Pipelines, Oil tanks, *Acoustic emission monitor

"Multi-channel acoustic emission monitoring system detects active cracks and leaks in pressure vessels, pipe lines, piping, storage tanks, bearings, gears and rotors." This may have applications in oil spill prevention. For further information write Rockwell International, Atomics International Division, 8900 De Soto Ave., Canoga Park, CA 91304.

C-0936-78
SANITARY-HYGIENIC CHARACTERISTICS OF THE URAL RIVER [in Russian]
Savel'ev, O.N., and P.I. Begishev. 1977.
Gigiena i Sanitariya Vol. 5:108-109.

Wastewaters, Pollution control, Petroleum products, USSR, Rivers, *Ural River

An analysis of the Ural River performed in 1970 indicated pollution from drainage and sewer water and from industrial effluents. Pollution control measures were implemented including measures for reducing the content of petroleum products in the river.

[from Biological Abstracts 65(6):#36562. 1978]

C-0937-78
LUBRICATION ENGINEERING AND PROTECTION OF THE ENVIRONMENT
Scheel, W.S. 1977.
Schmierungstechnik 8(5):164-167.

Lubricating oil, Pollution prevention, Oil slicks, Pollution control, Reuse, Disposal

"In this article an attempt is made to describe and explain the significance of lubrication as a potential environmental pollutant in the total complex of the culture of a country. The following problems are dealt with: the occurrence of oil slicks, their prevention and combating; the use of old lubricants as secondary raw material; the innocuous disposal of non-utilizable by-products."

[from Environmental Health and Pollution Control 13(1):#183. 1978]

C-0938-78
PETROLEUM REFINING INDUSTRY: ENERGY SAVING AND ENVIRONMENTAL CONTROL
Sittig, M. 1978.
New Jersey, Noyes Data Corporation, 1978. x + 374p.

Pollution control, Oil industry, Refineries, Sources, Regulations

"Many approaches to saving energy and avoiding pollution in petroleum refineries are presented in this volume." Included is a section on Water Pollution Control.

C-0939-78
MARITIME TECHNICAL-GRADE AGENTS FOR THE PREVENTION OF PETROLEUM-PRODUCT POLLUTION OF BODIES OF WATER [in Russian]
Tuv, I.A. 1976.
Moscow, USSR, Transport [Publishers], 1976. 129p.

Pollution prevention, Petroleum products, Spill cleanup

Summary not available.

[from Chemical Abstracts 88(18):#126014t. 1978]

C. ASPECTS OF OIL POLLUTION

1. BIOLOGICAL ASPECTS

C-0940-78
'LOST' OIL KILLS SEABIRDS (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(4):89

Birds, Mortality, Oil slicks, UK

In late January and February 1978 along the northeast coast of England, oiled dead and dying birds came ashore. More than 2,300 beached birds were counted along 100 km of coast extending south from the Scottish border. Although mostly guillemots, 20 species were collected, and actual mortality was estimated at higher than 20,000 birds. The Royal Society for the Protection of Birds believe a 5-km oil slick first sighted 20 km offshore was responsible.

C-0941-78
EFFECTS OF NO. 2 FUEL OIL ON COMMON EIDER EGGS
Albers, P.H., and R.C. Szaro. 1978.
Marine Pollution Bulletin 9(5):138-139.

Birds, Fuel oil, Mortality, *Embryotoxicity, *Eggs

Oil from the plumage and feet of an incubating common eider (Somateria mollissima) may be transferred to the eggs. External applications of 20 µl No. 2 fuel oil resulted in significantly greater embryonic mortality than in control clutches. The results are similar to those of a previous study of artificially incubated common eider eggs, and indicate that nest site conditions do not affect embryotoxicity of No. 2 fuel oil.

C-0942-78
PHYSIOLOGICAL STRESS AND RESPONSE IN CHRONICALLY OILED ORGANISMS
Anderson, J.W., and D.C. Malins. 1978.
Journal of the Fisheries Research Board of Canada 35(5):679-680.

Marine organisms, Hydrocarbons, Sediments, Chronic effects, Biological effects, Recovery

A summary and overview of Session II of the symposium on "Recovery Potential of Oiled Marine Northern Environments" is given. The papers presented during this session are very briefly reviewed, and recommendations are made for future work.

C-0943-78
IN VITRO METABOLISM OF XENOBIOTICS IN SOME MARINE ANIMALS
Bend, J.R., M.O. James, and P.M. Dansette. 1977.
Annals of the New York Academy of Sciences Vol. 298:505-521.
Proceedings.

Metabolism, Contaminants, Marine organisms, Vertebrates, Invertebrates, *Biotransformations

Described is the "microsomal mixed-function oxidase (MFO) activity in selected marine species native to the East Coast of North America with several substrates (benzo(a)-pyrene, benzphetamine, and 7-ethoxycoumarin), the further biotransformation of alkene and arene oxides by epoxide hydrase or glutathione with 3-methylcholanthrene (3-MC) on MFO and epoxide-metabolizing enzyme activities in two Florida marine species." [possibly oil pollution related]

C-0944-78
THE ACUTE TOXICITY OF SIX MONOCYCLIC AROMATIC CRUDE OIL COMPONENTS TO STRIPED BASS (MORONE SAXATILIS) AND BAY SHRIMP (CRANGON FRANCISCORUM)
Benville, P.E., Jr., and S. Korn. 1977.
California Fish and Game 63(4):204-209.

Toxicity, Crude oil, Acute effects, Bioassay, Aromatic hydrocarbons, *Morone saxatilis, *Crangon franciscorum

"The acute toxicities of benzene, toluene, ethylbenzene, p-xylene, m-xylene and O-xylene were determined for striped bass and bay shrimp by static bioassay....The toxic effect of the aromatics was more latent in shrimp than in fish as demonstrated by the difference in 24 and 96 h tests."

[from Biological Abstracts 65(6):#37102. 1978]

C-0945-78
UPTAKE OF WATER-SOLUBLE GASOLINE FRACTIONS AND THEIR EFFECT ON OXYGEN CONSUMPTION IN AQUATIC STAGES OF THE MOSQUITO (AEDES AEGYPTI (L.))
Berry, W.O., J.D. Brammer, and D.E. Bee. 1978.
Environmental Pollution 15(1):1-22.

Sublethal effects, WSF, Uptake, Gasoline, *Insects, *Oxygen consumption, *Aedes aegypti

Three sets of experiments are described in which the larval stages of the title organism were exposed to sublethal concentrations of water soluble fractions (WSF) of gasoline, or its components (benzene, toluene and xylenes) in the presence or absence of food. The experiments suggest that the WSFs are taken up by food particles and ingested by the insects.

C-0946-78
EFFECTS OF OIL ON BEHAVIORAL RESPONSES TO LIGHT, PRESSURE AND GRAVITY IN LARVAE OF THE ROCK CRAB CANCER IRRORATUS
Bigford, T.E. 1977.
Marine Biology 43(2):137-148.

Behavior, Biological effects, WSF, Fuel oil, Crustaceans, *Cancer irroratus

Behavioral changes in the response of rock crab (Cancer irroratus) larvae to light, pressure, and gravity after culture in varying concentrations of WSFs of No. 2 fuel oil were studied. Significant changes did occur and the results depended upon the concentration, larval stage, and combination of light, pressure and gravity tested.

[from Environmental Health and Pollution Control 13(2):#298. 1978]

C-0947-78
IMPACT OF ESTUARINE POLLUTION ON BIRDS
Blus, L.J., S.N. Wiemeyer, J.A. Kerwin, R.C. Stendell, et al. 1977.
Estuarine Pollution Control and Assessment, Proceedings of a Conference, Pensacola, Florida, 1975. Washington, D.C., US Environmental Protection Agency, Office of Water Planning Standards, 1977. Vol 1:57-71.

Birds, Estuaries, Environmental effects, Contaminants

"A review, with 62 references, of the impact of various types of pollution on birds." [possibly oil pollution related]

[from Chemical Abstracts 88(14):#94523q. 1978]

C-0948-78
THE PERSISTENCE OF CHRONICALLY ACCUMULATED HYDROCARBONS IN THE HARD SHELL CLAM MERCENARIA MERCENARIA
Boehm, P.D., and J.G. Quinn. 1977.
Marine Biology (Berlin) 44(3):227-233.

Hydrocarbons, Mollusks, Chronic effects, Uptake, Release, Rivers, *Mercenaria mercenaria

"Hard shell clams, from the chronically polluted Providence River were transferred to a clean lab system and the hydrocarbon contents of these transplanted clams were monitored for 120 days after transfer....A 41.9 μg/g wet wt. average initial hydrocarbon burden decreased to 29.3 μg/g, a decrease that became statistically significant only after 120 days. At most, only 30% of the clams' hydrocarbons were lost."

[from Chemical Abstracts 88(13):#84209c. 1978]

C-0949-78
RESULTS OF THE DAMAGING EFFECT OF WATER POLLUTANTS ON *DAPHNIA MAGNA* [English summary]
Bringmann, G., and R. Kuehn. 1977.
Zeitschrift fuer Wasser und Abwasser Forschung 10(5):161-166.

Mortality, Contaminants, Crustaceans, Marine organisms, *Lethal concentration, **Daphnia magna*

"The LC_{50} for 173 water pollutants on 24-h-old animals from a clone of *D. magna* is given. The LC_{50} for the majority of pollutants was 10-1000 mg/L." [possibly oil pollution related]

[from Chemical Abstracts 88(15):#99833a. 1978]

C-0950-78
LIMITING VALUES FOR THE DAMAGING ACTION OF WATER POLLUTANTS TO BACTERIA (*PSEUDOMONAS PUTIDA*) AND GREEN ALGAE (*SCENEDESMUS QUADRICAUDA*) IN THE CELL MULTIPLICATION INHIBITION TEST [English summary]
Bringmann, G., and R. Kuehn. 1977.
Zeitschrift fuer Wasser und Abwasser Forschung 10(3-4):87-98.

Bacteria, Algae, Toxicity, Chemical effects, Chemical analysis, *TGK values

"Using analogous methods of the cell multiplication inhibition test, the toxicity threshold (TGK) of 190 potential pollutants was determined for bacteria (*P. putida*) and green algae (*S. quadricauda*). The respective TGK values of these substances for *P. putida* and *S. quadricauda* are listed in the order of their concentrations at which inhibitory action began, to form a register of these indices of water toxicology." [possibly oil pollution related]

[from Applied Ecology Abstracts 4(1):#873-D4. 1978]

C-0951-78
ESTIMATE OF MAXIMUM LEVEL OF OIL INNOCUOUS TO MARINE BIOTA AS INFERRED FROM LITERATURE REVIEW
Brown, L.R. 1977.
Report CGR/DC-9/77, USCG-D-43-77, Contract DOT-CG-81-76-1476. 20p.
Final task report.

Toxicity, Marine organisms, *Innocuous oil level, *Review

Nearly 2,000 articles were reviewed, with 135 listed as references, in order to derive an estimate of the maximum level of oil considered harmless to the marine biological community.

[from Government Reports Announcements 77(25):#AD-A044 601/3GA. 1977]

C-0952-78
TOXICITY OF OIL SLICKS TO ARCTIC AMPHIPODS
Busdosh, M., and R.M. Atlas. 1977.
Arctic 30(2):85-92.

Toxicity, Oil spills, Amphipods, Arctic, Hydrocarbons

"A study was conducted to measure the toxicity of oil spills to Arctic amphipods. Exposure to oil resulted in death, especially if animals physically entered the slicks. Arctic diesel was more toxic than Prudhoe crude oil. Toxicity of Prudhoe crude oil was associated with the paraffinic and aromatic components. Exposure to the tarry asphaltic fraction of crude oil did not result in amphipod mortality."

[from Environmental Health and Pollution Control 13(2):#295. 1978]

C-0953-78
INVESTIGATIONS OF BREAKDOWN AND SUBLETHAL BIOLOGICAL EFFECTS OF TRACE PETROLEUM CONSTITUENTS IN THE MARINE ENVIRONMENT
Calder, J.A. 1977.
Pollutant Effects on Marine Organisms. C.S. Giam (ed.). Lexington, Massachusetts, Lexington Books, 1977. p. 31-32.

Toxicity, WSF, Crude oil, Hydrocarbons, Waste oil, Bacteria, Mollusks, Sublethal effects, Mortality

Laboratory studies of the toxicity of various hydrocarbons to marine bacteria showed that the inherent toxicity "increased inversely with solubility, such that naphthalene at 100 μm and benzopyrene at 0.02 μm concentration exhibited similar toxic effects..." Embryonic and larval stages of the quahog clam, *Mercenaria* sp., were exposed to WSFs of three crude oils, two refined oils, and one used motor oil. The motor oil was the most toxic tested, and larvae surviving exposure to any of the oils were always smaller than control and their continued development to healthy adult stages was uncertain.

C-0954-78
OBSERVATIONS OF A COLD-WATER INTERTIDAL COMMUNITY AFTER 5 YEARS OF A LOW-LEVEL, PERSISTENT OIL SPILL FROM THE *GENERAL M.C. MEIGS*
Clark, R.C., Jr., B.G. Patten, and E.E. DeNike. 1978.
Journal of the Fisheries Research Board of Canada 35(5):754-765.

Biological effects, Chronic effects, Uptake, Intertidal zone, Echinoderms, Weathering, **General M.C. Meigs* spill

A study was conducted on the effects and uptake of oil on an intertidal community exposed continually for 5 yr to oil spilled from the *General M.C. Meigs* in 1972 on the coast of Washington. Hydrocarbon uptake was evident in some species 2 months after the spill and even up to 5 yr afterward. The sea urchin *Strongylocentrotus purpuratus* was the only animal severely affected by the oil. Plant and algae populations were also affected. The weathering of the oil was also studied.

C-0955-78
EFFECTS OF PETROLEUMS ON THE GROWTH OF FRESHWATER ALGAE
Coffey, J.C., C.H. Ward, and J.M. King. 1977.
Industrial Waste Conference, 31st, Purdue University, Lafayette, Indiana, 1976. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p. 885-893.

Algae, WSF, Biological effects, Growth, Crude oil, Fuel oil, Freshwater

WSFs of two crude oils and a No. 2 fuel oil were tested on several freshwater algae. The fuel oil WSFs inhibited the growth of *Selenastrum capricornutum*, *Chlorella pyrenoidosa*, *Ankistrodesmus falcatus*, *Anabaena flos-aquae*, and *Mierocystis aeruginosa*, whereas WSFs of the crude oils did not. *Chlorella pyrenoidosa*, a green alga, was the most resistant to petroleum hydrocarbons.

C-0956-78
PRELIMINARY ECOLOGICAL-GENETIC COMPARISON BETWEEN UNPERTURBED AND OIL-IMPACTED *UROSALPINX CINEREA* (PROSOBRANCHIA: GASTROPODA) POPULATIONS: NOBSKA POINT (WOODS HOLE) AND WILD HARBOR (WEST FALMOUTH), MASSACHUSETTS
Cole, T.J. 1978.
Journal of the Fisheries Research Board of Canada 35(5):624-629.

Biological effects, Contamination, Mollusks, *Genetic structure, **Urosalpinx cinerea*, Buzzards Bay

The genetic structure of an oyster drill population in the Wild Harbor, a region of Buzzards Bay, which was contaminated by oil spilled in 1969 was compared to that of a stable population at Nobska Point over a 3-year period. The genotypes at the ODH and LAP loci were determined. More variation was found from year to year in the Wild Harbor population than in the Nobsaka Point population.

C-0957-78
THE SHETLAND WAY OF OIL (book review)
Conder, P., and M. Everett. 1978.
British Birds 71(1):49.

Birds, Biological effects, *Shetland Islands, UK

A brief review of a book entitled *The Shetland Way of Oil* [Shetland Islands, Thuleprint Ltd., 1976.] is given. A chapter on "Birds and Oil" by P. Kinnear is included.

C-0958-78
GENETIC TOXICOLOGY OF BENZENE, TOLUENE, XYLENES AND PHENOLS
Dean, B.J. 1978.
Mutation Research 47(2):75-97.

Aromatic hydrocarbons, Toxicity, *Mutagenicity, *Biotransformations, *Review

A review with 90 references is presented on the mutagenicity, biotransformations and toxicity of the title organic compounds. [possibly oil pollution related]

[from Chemical Abstracts 88(19):#131450m. 1978]

C-0959-78
TOXICITY OF WATER SOLUBLE FRACTIONS OF PETROLEUM OILS ON LARVAE OF CRABS
Donahue, W.H., M.F. Welch, W.Y. Lee, and J.A.C. Nicol. 1977.
Pollutant Effects on Marine Organisms. C.S. Giam (ed.). Lexington, Massachusetts, Lexington Books, 1977. p. 34-35, 77-94.

Crustaceans, WSF, Crude oil, Fuel oil, Toxicity, Mortality, *Larvae

The effects of WSFs on the survival of 6 species of crabs were investigated: (1) stone crab Menippe mercenaria, (2) spider crab Libinia dubia, (3) blue crab Callinectes sapidus, (4) calico crab Hepatus ephaliticus, (5) fiddler crab Uca panaceae, and (6) striped hermit crab Clibanarius vittatus. Results indicate that in 24-hour experiments crude oils were less toxic than their derivatives, fuel oil and Bunker C oil. Sensitivities of the species varied; blue and fiddler crabs were more resistant than stone crab zoeae.

C-0960-78
CYCLING OF POLLLUTANTS
Duke, T.W. 1976.
Estuarine Processes. Volume 1. Uses, Stresses, and Adaptation to the Estuary. M. Wiley (ed.). New York, Academic Press, 1976. p. 481-482.

Estuaries, Marshes, Microorganisms, Biodegradation, Biological effects, Bacteria

"Studies designed to determine the impact of oil on the estuarine environment are especially important with the increased interest in development and transport of off-shore oil. Of particular interest is knowledge concerning the effect of oil on estuarine microbial populations and the effect of the microbial populations on oil. Most marshes include a high percentage of cellulolytic bacteria, and these bacteria are important in the breakdown or metabolism of oil. The concept of seeding certain species of bateria or yeast is also of concern at this time."

C-0961-78
EFFECTS OF PETROLEUM-DISPERSING AGENTS ON BIOELECTRIC CHARACTERISTICS OF THE ALGA *NITELLA FLEXILIS* [in Russian]
Fedulova, A.N. 1976.
Biologicheski Nauki 19(10):31-35.

Dispersants, Biological effects, Algae, Toxicity, *Cell membranes, **Nitella flexilis*

A study was conducted on the effects of 5 oil dispersants on the potential across and electrical resistance of the cell membrane of the green algae *Nitella flexilis* and on the rates of cytoplasm movement. The dispersants caused destruction of the cell membranes and an increase in cell permeability. The degree of toxicity was reflected by relative decreases of potential difference.

[from Biological Abstracts 65(7):#41935. 1978]

C-0962-78
EFFECTS OF WATER SOLUBLE COMPONENTS OF REFINED OIL ON THE FECUNDITY OF THE COPEPOD, *TIGRIOPUS JAPONICUS*
Finney, C., and A. D'Agostino. 1977.
National Bureau of Standards Special Publications Vol. 464:627-631.

WSF, Fuel oil, Toxicity, Reproduction, Copepods, **Tigriopus japonicus*

"*T. japonicus* was less tolerant to the water soluble extracts of the no. 2 than the no. 6 fuel oil. The toxicity of the water extract of the no. 2 fuel oil was attributed to its relatively high content of low boiling aromatic hydrocarbons."

[from Chemical Abstracts 88(15):#99866p. 1978]

C-0963-78
INVESTIGATIONS ON THE BIOLOGICAL ELIMINATION OF HYDROCARBONS
Fusey, P., M-F. Lampin, and J. [illegible]dot. 1975.
Material und Organismen 10(2): [illegible]147.

Hydrocarbons, Release, Marine organisms

Summary not available. [possibly oil pollution related]

[from Marine Pollution Research Titles 4(3):#482. 1977]

C-0964-78
POLLUTANT EFFECTS ON MARINE ORGANISMS
Giam, C.S. (ed.). 1977.
Lexington, Massachusetts, Lexington Books, 1977. xi + 213p.

Biological effects, Hydrocarbons, WSF, Marine organisms, Algae, Invertebrates, *Proceedings

This volume presents the proceedings of a workshop held in May 1976 at Texas A&M University, College Station, Texas. Oil pollution related workshop papers [abstracted separately in this issue of OPR] are entitled as follows: "Investigations of Breakdown and Sublethal Biological Effects in Trace Petroleum Constituents in the Marine Environment" (J.A. Calder); "Toxicity of Water Soluble Fractions of Petroleum Oils on Larvae of Crabs" (W.H. Donahue, et al.); "Fuel Oils: Chemical Characterization and Toxicity to Microalgae" (K. Winters, et al.); "Aromatic Hydrocarbons: Distribution and Possible Fate in the Environment" (D.T. Gibson); and "Metabolism of Hydrocarbons in Marine Invertebrates: Aryl Hydrocarbon Hydroxylase from the Tissues of the Blue Crab, Callinectes sapidus and the Polychaete Worm, Nereis sp." (R.F. Lee, et al.).

C-0965-78

ALTERATIONS IN GROWTH AND PHYSIOLOGY OF SOFT-SHELL CLAMS, MYA ARENARIA, CHRONICALLY OILED WITH BUNKER C FROM CHEDABUCTO BAY, NOVA SCOTIA, 1970-76
Gilfillan, E.S., and J.H. Vandermeulen. 1978.
Journal of the Fisheries Research Board of Canada 35(5):630-636.

Biological effects, Mollusks, Fuel oil, Chronic effects, Uptake, Growth, *Carbon flux, *Mya arenaria, Chedabucto Bay

A Mya arenaria population in a lagoon oiled by the 1970 Arrow spill in Chedabucto Bay was compared to a population from a non-oiled lagoon six years after the spill. The parameters studied were sediment and tissue hydrocarbons, population structure, growth, and carbon flux. The oiled population showed fewer mature adults, a lag in tissue growth, a slower shell growth and a reduced carbon flux as compared to the non-oiled population.

C-0966-78

A STUDY OF PETROLEUM HYDROCARBONS FOUND IN THE SEDIMENTS OF LONG COVE, SEARSPORT, MAINE
Guerin, M. 1978.
Spill Technology Newsletter 3(1):39-40.

Oil spills, Mollusks, *Clams, Mortality, Chronic effects, Sediments, Maine

In 1971, rupture of an underground pipe in a tank farm at Searsport, Maine, resulted in spillage of at least 17,000 L (5,000 gal) of jet fuel and No. 2 fuel oil. The oil flowed into Long Cove, where it contaminated clam and worm flats. High initial clam and worm mortalities were reported; long-term studies to 1976 indicate a dramatic reduction in the standing population of clams in heavily oil-contaminated areas, and histopathologic abnormalities and incidences of tumors are abundant.

C-0967-78

EFFECTS OF CRUDE OILS AND THE OIL DISPERSANT COREXIT ON PRIMARY PRODUCTION OF ARCTIC MARINE PHYTOPLANKTON AND SEAWEED
Hsiao, S.I.C., D.W. Kittle, and M.G. Foy. 1978.
Environmental Pollution 15(3):209-221.

Biological effects, Crude oil, Dispersants, Phytoplankton, Algae, *Corexit, *Primary production

"Effects of crude oil and Corexit on primary production of arctic marine phytoplankton were studied in situ. The production rates varied with types and concentrations of crude oil, method of preparation of oil-seawater mixtures, environmental conditions and species composition of each sample tested. In samples with the same species composition, inhibition of production generally increased with increasing oil concentration. The crude oil-Corexit mixtures were more toxic than crude oil or Corexit alone."

C-0968-78

STUDIES ON PHOTOSYNTHETIC BACTERIA ISOLATED FROM AN ESTUARINE BEACH OF GOA
Karanth, N.G.K., S. Nair, and P.A.L. Bharathi. 1977.
Indian Journal of Marine Science 6(1):94-96.

Bacteria, Hydrocarbons, Biological effects, *CO_2 fixation

Studies on a bacterium in the family Athiorhodaceae isolated from an estuarine beach near Goa indicate that the bacterium could fix CO_2 under illumination and establish conditions for optimal growth. In tests of the response to 11 pollutants, CO_2 fixation was inhibited by hydrocarbons, NO_2^-, N_3^-, and fenitrothion.

[from Chemical Abstracts 88(15):#101770y. 1978]

C-0969-78

SUBLETHAL EFFECTS OF THE WATER-SOLUBLE FRACTION OF NIGERIAN CRUDE OIL ON THE JUVENILE HARD CLAMS, MERCENARIA MERCENARIA (LINNE)
Keck, R.T., R.C. Heess, J. Wehmiller, and D. Mauer. 1978.
Environmental Pollution 15(2);109-119.

Sublethal effects, WSF, Crude oil, Behavior, Growth, *Feeding rates, *Mercenaria mercenaria

The effect on the feeding behavior and growth of the juvenile hard clam Mercenaria mercenaria exposed to various WSF concentrations of Nigerian crude oil was studied. Feeding and growth rates of the experimental groups over a six-week period were found to be lower than those of controls. All clams in the highest WSF concentration (7 ppm) died during a two-week depuration period following the exposure period.

C-0970-78
STUDY OF COMBINED EFFECT OF PETROLEUM PRODUCTS AND DISPERSANTS ON PHYTOPLANKTON OF THE WHITE SEA [in Russian]
Kondrik, E.K., A.T. Terekhin, G.N. Devyatkova, and V.N. Maksimov. 1977.
Biologicheskie Nauki (Moscow) 20(11):141.

Phytoplankton, Petroleum products, Dispersants, Mortality, Arctic, *Corexit 7664, *Diproksamin 157

In the presence of 10 mg/L of diesel fuel, motor oil, or oil dispersant Corexit 7664, most species of the summer phytoplankton complex of the White Sea were killed. The same concentration of another oil dispersant, Diproksamin 157, seemed to have no effect on the phytoplankton complex. The overall effect was weaker in a combination of one oil product with another or with a dispersant than with individual substances.

[from Chemical Abstracts 88(22):#158082e. 1978]

C-0971-78
AQUATIC POLLUTANTS AND BIOLOGIC EFFECTS WITH EMPHASIS ON NEOPLASIA
Kraybill, H.F., C.J. Dawe, J.C. Harshbarger, and R.G. Tardiff (eds.). 1977.
Annals of the New York Academy of Sciences Vol. 298. 604p. Proceedings.

Fate, Distribution, PAH, Hydrocarbons, Carcinogens, Metabolism, Marine organisms, *Proceedings, *Neoplasia

Proceedings of the title conference, held in New York, September 1976, are presented. Included are the following 5 oil pollution-related papers [abstracted separately in this issue of OPR]: "Occurrence and Fate of Organic and Inorganic Contaminants in Marine Animals" (K.J. Whittle, et al.); "Global Distribution of Carcinogenic Pollutants in Water" (H.F. Kraybill); "Effects of Microbial Activity on Aquatic Pollutants" (M.J. Voll, et al.); "Metabolism of Aromatic Hydrocarbons in Marine Organisms" (D.C. Malins); and "*In Vitro* Metabolism of Xenobiotics in Some Marine Animals" (J.R. Bend, et al.).

C-0972-78
LONG-TERM EFFECTS OF AN OIL SPILL ON POPULATIONS OF THE SALT-MARSH CRAB *UCA PUGNAX*
Krebs, C.T., and K.A. Burns. 1978.
Journal of the Fisheries Research Board of Canada 35(5):648-649. [abstract]

Fuel oil, Contamination, Marshes, Recovery, Crustaceans, Biological effects, Buzzards Bay, **Uca pugnax*

A fuel oil spill at West Falmouth, Massachusetts, in 1969, contaminated salt marshes with up to 600 ppm oil per gram of mud, and adversely affected local populations of the fiddler crab, Uca pugnax. The oil pollution resulted in reduced crab density, reduced ratio of females to males, reduced juvenile settlement, heavy overwintering mortality, incorporation of oil in body tissues, and behavioral disorders in locomotion and abnormal burrow construction. As yet, recovery of the marsh from this relatively small spill is incomplete. [entire article published in Science 197(4302):484-487]

C-0973-78

BENZO(A)PYRENE MONOOXYGENASE INDUCTION IN MARINE FISH - MOLECULAR RESPONSE TO OIL POLLUTION

Kurelec, B., S. Britvic, M. Rijavec, W.E.G. Mueller, and R.K. Zahn. 1977.

Marine Biology (Berlin) 44(3):211-216.

Fish, Biological effects, Contamination, *Diesel 2 oil, *Blennius pavo

"Blennius pavo exposed to 170 ppb Diesel 2 oil showed an elevated benzo(a)pyrene monooxygenase ['I'] level after 14 days which was maintained through 60 days. ['I'] levels remained elevated even if the exposed fish were kept in clean water for 30 days....An oil spill caused an 8.5 fold increase in ['I'] levels in Blenniideae by the 23rd day."

[from Chemical Abstracts 88(13):#84207a. 1978]

C-0974-78

THE BIOLOGICAL EFFECTS OF THE WATER-SOLUBLE FRACTION OF A NO. 2 FUEL OIL ON THE PLANKTONIC SHRIMP, LUCIFER FAXONI

Lee, W.Y., K. Winters, and J.A.C. Nicol. 1978.

Environmental Pollution 15(3):167-183.

WSF, Fuel oil, Zooplankton, Sublethal effects, Behavior, *Lucifer faxoni

The biological activity of the planktonic shrimp Lucifer faxoni was measured after varying lengths of exposure to WSFs of No. 2 fuel oil 1) immediately after preparation of the solution, and 2) after a 48 hr exposure of the solution to air. Survival at varying lengths of exposure, feeding rate, degree of activity, and respiration were measured as a function of concentration for both WSF preparations. The freshly prepared WSF was found to be more toxic than the exposed WSF.

C-0975-78

SOME EFFECTS ON THE ECOLOGY OF A MARINE LITTORAL ZONE RECEIVING EFFLUENTS FROM A PETROLEUM REFINERY [English summary]
LePetit, J., M.-H. N'Guyen, and S. Tagger. 1977.
Environmental Pollution 13(1):41-56.

Refineries, Wastewaters, Environmental effects, Biodegradation, Bacteria, Phytoplankton, Intertidal zone

"The effects of a petroleum refinery effluent overflow in the sea on the physical and chemical characteristics, phytoplanktonic production and bacterial population have been studied....Bacteria utilising a gas-oil as the sole C source represent 10% of heterotrophic bacteria in the effluent area and 4% in an area not directly polluted by hydrocarbons. Physical and chemical conditions in the effluent area are not favorable to the phytoplanktonic population equilibrium, but seem to be so for a hydrocarbon degradation by bacteria."

[from Applied Ecology Abstracts 3(12):#3D14760. 1977]

C-0976-78

TECHNIQUES FOR STUDYING THE EFFECTS OF HYDROCARBONS ON MUSSEL LARVAE PHYSIOLOGY [English summary]
LeRoux, S., and A. Lucas. 1978.
Revue Internationale d'Oceanographie Medicale Vol. 49:75-79.

Toxicity, Hydrocarbons, Biological effects, Growth, *Mussels

The toxicity of n-decane, benzene, cyclohexane, and petroleum to mussels was investigated by studying the effects on larval locomotor activity, growth and O consumption. Experimental procedures and results are given.

[from Chemical Abstracts 88(23):#164971k. 1978]

C-0977-78

THE EFFECTS OF EKOFISK OIL AND OIL PRODUCTS ON MARINE FISH LARVAE
Lonning, S. 1977.
Astarte 10(1):37-48.

Biological effects, Crude oil, *Ekofisk oil, Fish, *Larvae

The effects of crude Ekofisk oil and of high and low boiling fractions were studied in three species of marine teleosts. The crude oil suspensions and high boiling fractions affected organogenesis and low boiling fractions often caused rapid cytolysis and irregular cleavage and development.

[from Biological Abstracts 65(8):#49256. 1978]

C-0978-78
BIOAVAILABILITY OF CRUDE OIL FROM EXPERIMENTALLY OILED SEDIMENTS TO ENGLISH SOLE (*POROPHRYS VETULUS*), AND PATHOLOGICAL CONSEQUENCES
McCain, B.B., H.O. Hodgins, W.D. Gronlund, and J.W. Hawkes, et al. 1978.
Journal of the Fisheries Research Board of Canada 35(5):657-664.

Fish, Uptake, Crude oil, Sediments, Toxicity, Biological effects, *Bioavailability, **Porophrys vetulus*

The bioavailability tissue hydrocarbon distribution, physiological changes and tissue pathology were studied in English sole exposed to sediments contaminated with crude oil. Hydrocarbon uptake from the sediments was demonstrated and evidence of long-term physiological and pathological stress after exposure was observed.

C-0979-78
EFFECTS OF LABORATORY PROCEDURE ON FUEL OIL TOXICITY
Michael, A.D., and B. Brown. 1978.
Environmental Pollution 15(4):277-287.

Toxicity, Fuel oil, Crustaceans, Amphipods, *Experimental variables, **Neohaustorius schmitzi*

"Laboratory testing of No. 2 fuel oil toxicity to the amphipod *Neohaustorius schmitzi* in artificial sea water demonstrated that each of several experimental factors produced significant variation in test results. Variables examined were: presence of substrate (sand), concentration of oil (0.05 or 0.025 ml/litre), stirring rate, age of the oil/water mixture, evaporation and temperature."

C-0980-78
EFFECT OF SOME PETROLEUM PRODUCTS AND DISPERSANTS ON BACTERIOPLANKTON OF THE WHITE SEA [in Russian]
Ogarkova, O.A., and V.N. Maksimov. 1977.
Biologicheskie Nauki (Moscow) 20(11):142.

Microorganisms, Bacteria, Petroleum products, Dispersants, *Diproksamin 157, *Corexit 7664

Microorganisms of the White Sea grow normally in the presence of increased concentrations of diesel fuel and motor oil. Diproksamin 157, an oil dispersant, in concentrations <100 mg/L promoted the propagation of microorganisms and heterotrophic bacteria, whereas 10 mg/L of Corexit 7664, another oil dispersant, caused a reduction of their number. Increasing concentrations of petroleum products weakens the negative effect of Corexit 7664.

[from Chemical Abstracts 88(22):#158083f. 1978]

C-0981-78

PATHOLOGICAL CHANGES IN A MARINE FISH AFTER A 6-MONTH EXPOSURE TO PETROLEUM

Payne, J.F., J.W. Kiceniuk, W.R. Squires, and G.L. Fletcher. 1978.
Journal of the Fisheries Research Board of Canada 35(5):665-667.

Chronic effects, Sublethal effects, Fish, Crude oil, *Tissues, *Tautogolabrus adspersus

After chronic exposure of Tautogolabrus adspersus to Venezuelen crude oil, the fish condition index, hematocrit, somatic indices of several tissues, eye lens diameter, plasma chloride, and tissue pathology were examined. "There were significant differences in testis somatic index, lens diameter, and plasma chloride between the two fish groups. No histopathological changes were observed."

C-0982-78

CRANKCASE OILS: ARE THEY A MAJOR MUTAGENIC BURDEN IN THE AQUATIC ENVIRONMENT?

Payne, J.F., I. Martins, and A. Rahimtula. 1978.
Science 200(4339):329-330.

Crankcase oil, Biological effects, PAH, *Mutagenic activity

PAH-enriched fractions from used crankcase oil induced mutagenic activity in Salmonella typhimurium strain TA 98 when activated with rat or trout liver extracts. Similarly prepared fractions from various crude oils and unused crankcase oils were nonmutagenic. Used crankcase oils may represent a considerable mutagenic threat to terrestrial and aquatic environments.

C-0983-78

EFFECTS OF CHRONIC EXPOSURE TO PETROLEUM UPON THE GROWTH AND MOLTING OF JUVENILES OF THE ARCTIC MARINE ISOPOD CRUSTACEAN MESIDOTEA ENTOMON

Percy, J.A. 1978.
Journal of the Fisheries Research Board of Canada 35(5):650-656.

Biological effects, Chronic effects, Crustaceans, WSF, Crude oil, Growth, *Molting, *Mesidotea entomon

Mesidotea entomon juveniles were chronically exposed to WSFs of fresh and weathered Norman Wells crude and fresh Pembina crude oils. Lethal effects, growth, and effects on various aspects of the molt cycle were observed. The results indicate that growth and molting are not significantly affected by petroleum except at concentrations approaching the chronic lethal level.

C-0984-78
USES OF THE SEA (book review)
Portmann, J.E. 1978.
Marine Pollution Bulletin 9(1):27-28.

Biological effects, Sources, Tankers, Carcinogens, Book review

A favorable review is given of the book *The Marine Environment* Vol. 5 [J. Lenihan and W.W. Fletcher (eds.). Glasgow & London, Blackie, 1977. xi + 170p.]. This is the fifth of a series entitled *The Environment and Man*, and one chapter, written by Nelson-Smith, is devoted to oil pollution. The main theme of the chapter is biological effects, including carcinogenesis. Sources of pollution and tanker improvements are also mentioned.

C-0985-78
THE EFFECT OF PRUDHOE BAY CRUDE OIL ON SURVIVAL AND GROWTH OF EGGS, ALEVINS, AND FRY OF PINK SALMON, *ONCORHYNCHUS GORBUSCHA*
Rice, S.D., D.A. Moles, and J.W. Short. 1975.
Conference on Prevention and Control of Oil Pollution, San Francisco, 1975. p. 503-507.

Crude oil, Fish, Acute effects, Mortality, Growth, Bioassay, Prudhoe Bay, **Oncorhynchus gorbuscha*

"Standard 96-hr bioassays with total oil solutions in fresh water and seawater tested differences in sensitivity of the developing life stages of pink salmon. Eggs were the most resistant and emergent fry the most sensitive to acute 4-day exposures. Susceptibility was greater in seawater after fry migration."

[from Ecological Abstracts No. 2:#77L/1623. 1977]

C-0986-78
UPTAKE OF HYDROCARBONS FROM MARINE SEDIMENTS CONTAMINATED WITH PRUDHOE BAY CRUDE OIL: INFLUENCE OF FEEDING TYPE OF TEST SPECIES AND AVAILABILITY OF POLYCYCLIC AROMATIC HYDROCARBONS
Roesijadi, G., J.W. Anderson, and J.W. Blaylock. 1978.
Journal of Fisheries Research Board of Canada 35(5):608-614.

Uptake, Hydrocarbons, PAH, Invertebrates, Sediments, Crude oil, Prudhoe Bay

The uptake of hydrocarbons in benthic animals exposed to sediments contaminated with Prudhoe Bay crude oil was studied. Deposit feeders accumulated more hydrocarbons than suspension feeders. In experiments with radiolabeled aromatic hydrocarbons, it was found that sediment-bound hydrocarbons were less available for uptake than hydrocarbons released to the surrounding water.

C-0987-78
BIOAVAILABILITY OF NAPHTHALENES FROM MARINE SEDIMENTS ARTIFICIALLY CONTAMINATED WITH PRUDHOE BAY CRUDE OIL
Roesijadi, G., D.L. Woodruff, and J.W. Anderson. 1978.
Environmental Pollution 15(3):223-229.

Uptake, *Naphthalenes, Sediments, Crude oil, Mollusks, Prudhoe Bay, *Macoma inquinata

The uptake of naphthalenes from sediments contaminated with Prudhoe Bay crude oil by the detrivorous clam Macoma inquinata was studied. The results indicated that naphthalene uptake directly from ingestion of the contaminated sediment was insignificant.

C-0988-78
EFFECTS OF NO. 2 FUEL OIL WATER-SOLUBLE-FRACTIONS ON GROWTH AND REPRODUCTION IN NEANTHES ARENACEODENTATA (POLYCHAETA: ANNELIDA)
Rossi, S.S., and J.W. Anderson. 1978.
Water, Air, and Soil Pollution 9(2):155-170.

WSF, Fuel oil, Sublethal effects, Growth, Reproduction, Polychaetes, *Neanthes arenaceodentata

The effects on growth and reproduction in the title organism after acute and chronic sublethal exposure to WSFs of No. 2 fuel oil were studied. Hatching of metatrochophore larvae was inversely proportional to WSF concentration and exposure time. Growth of larvae into juveniles was not affected by exposure to low WSF concentration. Growth of juveniles into adults after chronic exposure was inversely related to WSF concentration. The effects on oocyte maturation, fecundity, larval development, and brood mortality are also reported.

C-0989-78
ACCUMULATION AND METABOLISM OF CARBON-14 LABELED BENZENE, NAPHTHALENE, AND ANTHRACENE BY YOUNG COHO SALMON (ONCORHYNCHUS KISUTCH)
Roubal, W.T., T.K. Collier, and D.C. Malins. 1977.
Archives of Environmental Contamination and Toxicology 5(4):513-529.

Metabolism, Aromatic hydrocarbons, PAH, Fish, Chromatography, *Oncorhynchus kisutch

The accumulation and metabolic fate of benzene, naphthalene and anthracene labeled with C^{14} and injected into young Oncorhynchus kisutch was studied. The results indicated that the aromatic hydrocarbons in major organs increased in relation to the number of benzenoid rings, and that aromatic metabolites are distributed widely throughout fish exposed to PAHs.

[from Aquatic Sciences and Fisheries Abstracts Part 1 8(1):783-1Q8. 1978]

C-0990-78
FLORIDA OIL SPILL IMPACT ON THE BUZZARDS BAY BENTHIC FAUNA: WEST FALMOUTH
Sanders, H.L. 1978.
Journal of the Fisheries Research Board of Canada 35(5):717-730.

Florida spill, Benthos, Marine organisms, Intertidal zone, Sediments, Statistical analysis, Buzzards Bay

Several stations in Buzzards Bay, ranging from heavily oiled to unoiled, were monitored and compared for oil concentration and composition, and species densities and composition over a 3-year period. Several statistical methods were employed in analyzing the samples. The results are presented in a series of graphs.

C-0991-78
ACUTE LETHAL TOXICITY OF COREXIT 9527/PRUDHOE BAY CRUDE OIL MIXTURES TO SELECTED ARCTIC INVERTEBRATES
Sekerah, A., and M. Foy. 1978.
Spill Technology Newsletter 3(2):37-41.

Crude oil, Dispersants, Toxicity, Crustaceans, Mortality, Acute effects, Arctic, *Corexit 9527

Three Arctic amphipods (*Onisimus litoralis*, *Boeckosimus edwardsi*, *Anonyx nugax*), and an Arctic copepod (*Calanus hyperboreus*) were exposed to crude oil and oil/dispersant mixtures. Ninety-six hour LC_{50} bioassay tests were used to determine mortalities of the species. Mortalities were generally greater with the oil/dispersant mixtures than with either substance alone. The amphipod *A. nugax* was consistently the most sensitive species; the copepod was surprisingly resistant to the acute toxic effects of the oil and the dispersant.

C-0992-78
RESPONSE OF MICROBIAL POPULATIONS IN ARCTIC TUNDRA SOILS TO CRUDE OIL
Sexstone, A.J., and R.M. Atlas. 1977.
Canadian Journal of Microbiology 23(10):1327-1333.

Crude oil, Biodegradation, Biological effects, Microorganisms, Soil, Arctic

Experimental crude oil spills were conducted on four major topographically distinct soils of arctic coastal polygonized tundra. Results indicate the response of microbial populations to contaminating oil is dependent on soil type and depth.

[from Applied Ecology Abstracts 4(3):#3254-D4. 1978]

C-0993-78
ECOLOGICAL-BIOCHEMICAL CHARACTERISTICS OF THE HYDROCARBONS OF SOME ORGANISMS OF THE MEDITERRANEAN SEA [in Russian]
Shchekaturina, T.L. 1978.
Gidrobiologicheskie Zhurnal 14(1):99-103.

Hydrocarbons, Uptake, Invertebrates, Bioindicators, Mediterranean Sea, *Mytilus galloprovincialis

Measured hydrocarbon content in echinoderms, arthropods, and mollusks from the Mediterranean Sea varied between 3.4-99 mg/100 g wet wt. Mussels (Mytilus galloprovincialis) contained the highest concentration of hydrocarbons. "Gas chromatography analysis revealed the presence of C_{11}-C_{19} normal alkanes and branched C_{14}-C_{20} alkanes of both natural and petroleum origin. The sea hydrobionts may be used as an indicator of petroleum pollution."

[from Chemical Abstracts 88(21):#149235e. 1978]

C-0994-78
THE EFFECT OF OIL POLLUTION ON THE PHYSIOLOGY OF MYA ARENARIA L., WITH SPECIAL REFERENCE TO THE EFFECT UPON RESPIRATION AND MODE OF ACCUMULATION
Stainken, D.M. 1975.
Rutgers University, PhD Dissertation. 129p.

Fuel oil, Mollusks, Toxicity, Uptake, Release, Behavior, *Respiration, *Mya arenaria

The TL_{50}, behavior, and mode of oil accumulation were studied in soft-shell clams exposed to No. 2 fuel oil. Acute toxicity was dependent upon temperature, and greater mortality was observed at 14°C than at 4°C. A dyed oil emulsion was used to determine the mode of accumulation. Oil micelles and globules were treated as food and much oil was bound by mucus secreted from the gill ctenidia and ingested or rejected by ciliary pathways. Low oil concentrations doubled respiratory rates while higher concentrations depressed rates. Uptake and depuration of oil by clams as well as histological effects of oil exposure were also studied.

[from Dissertation Abstracts International B 38(3):1088. 1977]

C-0995-78
EFFECTS OF UPTAKE AND DISCHARGE OF PETROLEUM HYDROCARBONS ON THE RESPIRATION OF THE SOFT-SHELL CLAM, MYA ARENARIA
Stainken, D.M. 1978.
Journal of the Fisheries Research Board of Canada 35(5):637-642.

Sublethal effects, Uptake, Release, Hydrocarbons, Mollusks, Fuel oil, *Respiration rates, *Mya arenaria

The respiratory rates of young Mya arenaria exposed to different concentrations of No. 2 fuel oil-in-water emulsions, and hydrocarbon accumulation by the clams were observed over a 28-day exposure period. Respiratory rates were elevated at low oil concentrations and depressed at high concentrations. The rates approached those of controls following a 14-day depuration period, but remained significantly altered from the control rates.

C-0996-78
INFLUENCE OF ENVIRONMENTAL CONTAMINATION ON CYTOCHROME P-450 MIXED-FUNCTION OXYGENASES IN FISH: IMPLICATIONS FOR RECOVERY IN THE WILD HARBOR MARSH
Stegeman, J.J. 1978.
Journal of the Fisheries Research Board of Canada 35(5):668-674.

Contamination, Biological effects, Recovery, Florida spill, Buzzards Bay, *Fundulus heteroclitus

Elevated levels of benzo[a]pyrene hydroxylase, aminopyrine demethylase, and cytochrome P-450 were found in fish from Wild Harbor Marsh, which was contaminated by oil spilled in 1969 from the Florida. Levels were compared to those in fish from uncontaminated areas of Buzzards Bay, Massachusetts. These results indicate that recovery of Wild Harbor Marsh is not yet complete.

C-0997-78
PETROLEUM: EFFECTS ON MALLARD EGG HATCHABILITY
Szaro, R.C., P.H. Albers, and N.C. Coon. 1978.
Journal of Wildlife Management 42(2):404-406.

Biological effects, Birds, Contamination, Mortality, *Eggs, *Hatchability

In order to assess the effects of oil contamination on aquatic bird eggs, mallard eggs were experimentally exposed to 2 crude oils (South Louisiana and Kuwait crude) and a refined oil (No. 2 fuel oil) on the eigth day of incubation. Care was taken to eliminate the possibility that hatching success was influenced by an interruption of normal gaseous exchange. It was found that minute amounts of oil are sufficient to produce marked reductions in mallard hatchability, and that the mortality was due to the aromatic portion of the tested oils, and not the aliphatic portion.

C-0998-78
CAMPARISON OF OILED AND UNOILED INTERTIDAL COMMUNITIES IN CHEDABUCTO BAY, NOVA SCOTIA
Thomas, M.L.H. 1978.
Journal of the Fisheries Research Board of Canada 35(5):707-716.

Intertidal zone, Biomass, Biological effects, Sediments, Hydrocarbons, Chedabucto Bay

Four oiled intertidal regions in Chedabucto Bay were compared with four unoiled regions. Significant differences were found between abundance and biomass data, length and weight data for *Mya arenaria* and *Littorina littorea*, and oil concentrations in biota and sediments between the oiled and unoiled stations.

C-0999-78
THE EFFECT OF CRUDE OIL AND CRUDE OIL/COREXIT 9527 SUSPENSIONS ON CARBON FIXATION BY A NATURAL MARINE PHYTOPLANKTON COMMUNITY
Trudel, B.K. 1978.
Spill Technology Newsletter 3(2):56-64.

Dispersants, Crude oil, Toxicity, Seawater, Phytoplankton, *Carbon fixation, *Corexit 9527

The title study used oil-seawater and oil-dispersant-seawater suspensions containing 0.01 to 6.0 mg/ml oil. Results of the experiments suggest that oil dispersed with Corexit 9527 is no more toxic to phytoplankton than oil that has been dispersed physically. Concentrations of oil in seawater as low as 0.10 μg/ml caused a 10% reduction of carbon fixation in both types of suspensions.

C-1000-78
ABSENCE OF ARYL HYDROCARBON HYDROXYLASE (AHH) IN THREE MARINE BIVALVES
Vandermeulen, J.H., and W.R. Penrose. 1978.
Journal of the Fisheries Research Board of Canada 35(5):643-647.

Biological effects, Mollusks, Metabolism, Crude oil, Fuel oil, Food web, *Enzyme activity

Three marine bivalve species were assayed for AHH and N-demethylase activity following 4-day and 6-year exposures to aqueous extracts of Kuwait crude or Bunker C fuel oils. No activity was found in any of the clams, indicating that unaltered aromatic hydrocarbons may accumulate in the clam tissues in polluted areas and eventually enter the food chain. Enhancement of AHH activity in trout exposed to oil was observed.

2. PHYSICAL/CHEMICAL ASPECTS

C-1001-78
EFFECTS OF OILS ON TEXTURE AND TASTE
Dall, K., G.E. O'Ficks, B. Owman, G. Rahame, and L.E. Wis. 1978.
Marine Pollution Bulletin 9(4):95-97.

Sublethal effects, Contamination, Hydrocarbons

The effects of a range of product oils on texture and taste were tested on two common species, Melanogrammus aeglefinus and Solanum tuberosum. The authors concluded, "increased palatability occasioned by medium range conditions appears to be a phenomenon new to oil pollution science. It suggests that if oil could be transported at the appropriate temperature, some of the adverse consequences of a spill would be minimized."

C-1002-78

THE EFFECT OF TAR CONTAMINATION ON THE EXTRACTABLE METAL LEVELS IN SOIL
Pulford, I.D., and H.J. Duncan. 1977.
Plant and Soil 46(3):695-697.

Tar, Chemical analysis, *Trace metals, Soil

"Tar contaminated soil was analysed for extractable trace metal content. All the metals analysed, with the exception of Ni, were present at higher levels than in normal agricultural soil."

[from Applied Ecology Abstracts 4(1):#924-D4. 1978]

3. SOCIAL/ECONOMIC ASPECTS

[No entries.]

4. ENVIRONMENTAL RESTORATION AND RECOVERY

C-1003-78
AMOCO CADIZ SEEMS LIKELY TO EXTERMINATE THE FRENCH AUKS (news brief)
Bourne, W.R.P. 1978.
Marine Pollution Bulletin 9(6):145.

Birds, Amoco Cadiz spill, Torrey Canyon spill, Recovery, Contamination

From an ornithological viewpoint, the wreck of the Amoco Cadiz could hardly have occurred at a worse time or place. In the 1967 Torrey Canyon spill, where oil covered the same area in France, the small population of three auk species, guillemot, razorbill, and puffin, were devastated, declining from over 3000 breeding pairs to 500 pairs since. The recent spill of the worst type of light oil probably means the end of the auk populations.

C-1004-78
OIL POLLUTION IN THE BALTIC (news brief)
Bourne, W.R.P. 1978.
Marine Pollution Bulletin 9(1):5.

Contamination, Birds, Mortality, Recovery, Baltic Sea

Two articles are noted which report an improvement in pollution levels and resulting wildlife effects in the Baltic. Dramatic decreases in bird mortality have occurred. Factors involved include 1) increasing oil prices combined with improved recycling methods, 2) increased public sympathy with environmental protection, and 3) improved control and surveillance.

C-1005-78
SAVING OILED SEABIRDS (news brief)
Bourne, W.R.P. 1978.
Marine Pollution Bulletin 9(5):117.

Birds. Restoration, API, Book review

The title booklet describes the best established techniques for rehabilitating oiled birds. A new technique, tube-feeding to restore fluid and electrolyte balances, is also explained. [The booklet is abstracted separately in this issue of OPR:#C-1009-78.]

C-1006-78
RECOVERY AND RESTORATION OF DAMAGED ECOSYSTEMS
Cairns, J., Jr., K.L. Dickson, and E.E. Herricks (eds.). 1977.
Charlottesville, University Press of Virginia, 1977. x + 531p.

Recovery, Ecosystems, Environmental deterioration, Resource management

[Summary not available.]

C-1007-78

OILED SEABIRD RESCUE AND CONSERVATION
Clark, R.B. 1978.
Journal of the Fisheries Research Board of Canada 35(5):675-678.

Restoration, Conservation, Birds, Oil spills, Torrey Canyon spill

The rescue and rehabilitation of 8,000 oiled seabirds was attempted following the Torrey Canyon oil spill in 1967. The failure of this effort resulted in the establishment of the Research Unit on the Rehabilitation of Oiled Seabirds in the University of Newcastle-upon-Tyne. An effective and inexpensive method for cleaning birds has been developed by the Research Unit, and some birds have been successfully returned to the breeding population.

C-1008-78

NO. 2 FUEL OIL SPILL IN BOURNE, MASSACHUSETTS: IMMEDIATE ASSESSMENT OF THE EFFECTS ON MARINE INVERTEBRATES AND A 3-YEAR STUDY OF GROWTH AND RECOVERY OF A SALT MARSH
Hampson, G.R., and E.T. Moul. 1978.
Journal of the Fisheries Research Board of Canada 35(5):731-744.

Fuel oil, Invertebrates, Benthos, Restoration, Recovery, Marshes, Bouchard 65 spill, Buzzards Bay

Benthic samples from the region of Buzzards Bay affected by the 1974 Bouchard 65 spill were collected within two weeks of the spill for a qualitative assessment of the spill impact, and again in 1977 for a quantitative assessment of the recovery of the area. The following conditions were observed in the polluted marsh as compared to a control site in the 1977 study: inability of marsh grass to become reestablished, higher erosion rates, fewer algal species, and reduced numbers of individuals and species of interstitial fauna.

C-1009-78

SAVING OILED SEABIRDS
International Bird Rescue Research Center. 1978.
Washington, D.C., American Petroleum Institute, 1978. ix + 35p.

Birds, Restoration, Oil slicks, Manuals

This manual provides comprehensive instructions on the cleaning and care of oiled seabirds. Included are sections on collection and treatment of birds, care in captivity, cleaning and drying, and preparation for release. The booklet may be ordered for $.35 by contacting the Distribution Services, American Petroleum Institute, 2101 L St., N.W., Washington, D.C. 20037.

C-1010-78
RECOVERY OF BENTHIC MACROFAUNA FROM CHRONIC POLLUTION IN THE SEA AREA OFF A REFINERY PLANT, SOUTHWEST FINLAND
Leppäkoski, E.J., and L.S. Lindström. 1978.
Journal of the Fisheries Research Board of Canada 35(5):766-775.

Benthos, Recovery, Refineries, Wastewater treatment, Chronic effects, Distribution, Biomass, *Recolonization

A study was conducted on the density, wet weight biomass, Shannon diversity, species richness, and evenness of distribution of benthic macrofauna in an oil refinery area before and after the installation of a wastewater treatment plant which reduced oil and wastewater discharges from the refinery. Laboratory experiments indicated decreased toxicity of sediments from the sampling sites affected by refinery effluents following the plant's installation. Recovery of the area was demonstrated.

C-1011-78
SOIL RESTORATION FOLLOWING OIL SPILLS - A REVIEW
McGill, W.B. 1977.
Journal of Canadian Petroleum Technology 16(2):60-67.

Spill removal, Soil, Restoration, Oil spills

"A review, with 50 references, and discussion of the nonbiological mechanism of oil removal from soil and biological restoration methods [are presented]."

[from Chemical Abstracts 88(7):#49482q. 1978]

C-1012-78
LONG-TERM EFFECTS OF OIL SPILLS ON MARINE INTERTIDAL COMMUNITIES
Mann, K.H., and R.B. Clark. 1978.
Journal of the Fisheries Research Board of Canada 35(5):791-795.

Chronic effects, Intertidal zone, Recovery, Ecosystems, *Symposium summary

A summary and overview of Session III of the symposium on the "Recovery Potential of Oiled Marine Northern Environments" is presented. The authors discuss the problems associated with the use of "controls" or "reference sites," the use of species diversity and productivity as "good indices of the integrated performance of ecosystems," the capacity for polluted marine environments to assimilate oil, the use of the concept of recovery time in weighing the seriousness of pollution, and the need for further studies at the ecosystem level.

C-1013-78
OIL POLLUTION MANUAL
Nature Conservancy Council. n.d.
London, Nature Conservancy Council, n.d. 27p.

Restoration, Manuals, Guidelines, Wildlife

Guidelines for saving and restoring oiled wildlife have been developed by various nature conservation and animal welfare organizations, and are presented in this manual. Copies are available from the Administrative Division, Nature Conservancy Council, 19/20 Belgrave Square, London SWIX 8PY, England.

C-1014-78
LONG-TERM EFFECTS OF AN OIL SPILL ON FUCUS MACROFAUNA IN A SMALL BALTIC BAY
Notini, M. 1978.
Journal of the Fisheries Research Board of Canada 35(5):745-753.

Recovery, Marine organisms, Chronic effects, Intertidal zone, Baltic Sea, *Fucus vesiculosus, *Irini spill

Recolonization of a Fucus vesiculosus community in Gästviken Bay in the Baltic Sea following the 1970 Irini spill was studied over a 5-year period. The mean number of individuals for the observed species rose during the sampling period with the exception of Chironomidae larvae which showed a decreased density. The data are discussed with respect to the normal seasonal variations in the littoral flora and fauna.

C-1015-78
ASSESSMENT OF THE MACROBENTHOS IN AN ANTARCTIC ENVIRONMENT FOLLOWING RECENT POLLUTION ABATEMENT
Platt, H.M. 1978.
Marine Pollution Bulletin 9(6):149-153.

Recovery, Statistical analysis, Fuel oil, Contamination, Antarctica

"Quantitative population data for shallow antarctic soft-bottom communities in King Edward Cove, South Georgia, indicate that although once grossly polluted by organic effluent and fuel oil from a whaling station, the fauna recovered within some eight years after contamination ceased. The results are discussed in relation to comparable studies in other polar and temperate areas."

C-1016-78
RECOLONIZATION OF ROCKY SHORES IN CORNWALL AFTER USE OF TOXIC DISPERSANTS TO CLEAN UP THE *TORREY CANYON* SPILL
Southward, A.J., and E.C. Southward. 1978.
Journal of the Fisheries Research Board of Canada 35(5):682-706.

Dispersants, Recovery, *Recolonization, Shorelines, Beach cleanup, Marine organisms, *Torrey Canyon* spill, UK

The effects of the dispersants used to treat the *Torrey Canyon* oil spill in 1967 on the flora and fauna along the coast of Cornwall and the sequence of recolonization are described. The authors conclude that the recovery of the shores affected by the spill has not been as rapid or complete as previous literature has indicated.

C-1017-78
RECOVERY POTENTIAL OF OILED MARINE NORTHERN ENVIRONMENTS
Stevenson, J.C. (ed.). 1978.
Journal of the Fisheries Research Board of Canada 35(5):499-796.
Proceedings.

Recovery, Ecosystems, Fate, Biological effects, Intertidal zone, *Proceedings

The symposium on "Recovery Potential of Oiled Marine Northern Environments" was held in Halifax, Nova Scotia in October 1977. The proceedings are presented in this special issue. [Individual papers are abstracted separately in this issue of OPR.]

C-1018-78
DISTRIBUTION AND ABUNDANCE OF HYDROCARBON-UTILIZING BACTERIA IN SEDIMENTS OF CHEDABUCTO BAY, NOVA SCOTIA, IN 1976
Stewart, J.E., and L.J. Marks. 1978.
Journal of Fisheries Research Board of Canada 35(5):581-584.

Biodegradation, Recovery, Microorganisms, Bacteria, Sediments, Distribution, Chedabucto Bay

Analysis of sediment samples taken from Chedabucto Bay, the site of a major oil spill in 1970, revealed that, with two exceptions, the numbers of hydrocarbon-utilizing microorganisms had returned to levels comparable to those found in relatively unpolluted areas.

C-1019-78
INTRODUCTION TO THE SYMPOSIUM ON RECOVERY POTENTIAL OF OILED MARINE NORTHERN ENVIRONMENTS
Vandermeulen, J.H. 1978.
Journal of the Fisheries Research Board of Canada 35(5):505-508.

Recovery, Ecosystems, Intertidal zone, Environmental effects

An introduction is presented to the papers given at the title symposim, held in Halifax, Nova Scotia in October 1977. The themes and most important points brought out at the symposium are discussed.

5. GENERAL ASPECTS

C-1020-78
CLEAN OCEANS A MUST
Anon. 1977.
Environmental Policy Law 3(2):62-63.

Oceans, Environmental deterioration, Resource management, Recovery, Conservation

"Oceans have been used as waste receptacles but because physical, chemical and biological processes do not work rapidly in the sea, wastes accumulate. The critical ocean pollutants are metals, persistant organic chemicals, petroleum hydrocarbons, radionuclides and solid wastes." Many groups of various scopes of interest on regional to international levels are involved in plans for the recovery, conservation, and protection of the marine environment.

[from Applied Ecology Abstracts 3(12):#3D14806. 1977]

C-1021-78
THE COASTLINE
Barnes, R.S.K. (ed.). 1977.
New York, John Wiley & Sons, 1977. xii + 356p.

Coasts, Habitats, Biological effects, Environmental effects, Coastal zone management, Spill cleanup

Thirteen coastal habitats are described in detail, with emphasis placed on man-made pressures and appropriate management. Oil pollution is considered throughout.

C-1022-78

RIVER POLLUTION STUDIES
Best, G.A., and S.L. Ross. 1977.
Liverpool, Liverpool University Press, 1977. vii + 92 p.

Rivers, Wastewaters, Contaminants, Sources, Analytical techniques, Biological effects

This book is an introduction to the sources, methods of analysis, and effects of various river pollutants including oil.

C-1023-78

TOXICOLOGY OF ALIPHATIC AND AROMATIC HYDROCARBONS
Bruckner, J.V., and R.G. Peterson. 1977.
NIDA Research Monographs No. 15:124-163.

Toxicity, Aromatic hydrocarbons, *Aliphatic hydrocarbons, *Review

"A review with many references." [possibly oil pollution related]

[from Chemical Abstracts 88(17):#115853q. 1978]

C-1024-78

PACIFIC SEASHORES: A GUIDE TO INTERTIDAL ECOLOGY
Carefoot, T. 1977.
Seattle, University of Washington Press, 1977. 208p.

Intertidal zone, Biological effects, Sources, Spill cleanup, Pacific Ocean

Chapter 7 of this book deals with marine pollution. The section on oil includes discussions of some major oil spills and their effects, sources of oil pollution, and methods and problems in cleaning up spills.

C-1025-78

SUMMING UP AND CONSIDERATION OF FUTURE RESEARCH NEEDS
Cole, H.A. 1975.
Proceedings of the Royal Society of London, Series B 189(1096): 479-483.

Biological effects, Biodegradation, Contamination, Hydrocarbons, Marine organisms, *Conference summary

The results of a meeting on organic pollutants and their behavior in the marine environment are summarized. A paper by Hughes and McKenzie on microbial degradation of oil mentions the problem of persistent tar balls; Corner discusses the biological transformation of petroleum hydrocarbons in marine species; Elias assesses health hazards of organic pollutants; and laboratory identification of organic pollutants, and of their acute and chronic effects are covered by Eglington et al., and Wilson, respectively. [Each paper is abstracted separately in this issue of OPR.]

C-1026-78
PHYSIOLOGICAL TESTS FOR STUDYING MARINE POLLUTION [English summary]
Harichaux, P., J. Gorin, and B. Dereumaux. 1978.
Revue Internationale d'Oceanographie Medicale Vol. 49:63-74.

Biological effects, Marine organisms, Detection, *Review

"A review with 94 references." [possibly oil pollution related]

[from Chemical Abstracts 88(23):#164945e. 1978]

C-1027-78
IMPACT OF ADSORBED PETROLEUM HYDROCARBONS ON MARINE ORGANISMS
Ho, C.L., and H. Karim. 1978.
Marine Pollution Bulletin 9(6):156-162.

Adsorption, Absorption, Crude oil, Sediments, Mollusks, Uptake,
* Oysters

Adsorption of South Louisiana crude oil by clay, non-clay minerals, and sediments was analyzed. Hydrocarbon absorption by oysters from sediment-adsorbed and water dispersed crude oil was studied. Also examined was the nature of residual hydrocarbons in oysters after depuration in natural water, the effect of petroleum hydrocarbons in sediment upon oysters and the effect of surface-coated petroleum on recruitment of sedentary organisms under natural conditions.

C-1028-78
HYGIENIC CHARACTERISTICS OF BEACHES OF SUBURBAN AREAS OF BAKU [in Russian]
Kasimov, M.S., N.G. Efendieva, and N.N. Bochkareva. 1977.
Azerbaidzhanskii Meditsinskii Zhurnal 54(6):45-48.

Contamination, Beaches, Seawater, Soil, Hydrocarbons, Petroleum products, USSR

The seawater at beaches on the Absheron is contaminated "considerably higher than accepted standards," particularly by oil products. Contamination of air and soil by hydrocarbons is also noted.

[from Chemical Abstracts 88(4):#27507z. 1978]

C-1029-78
COMMENTARY
Ketchum, B.H. 1978.
Ocean Reporter (April-May):23.

Environmental effects, Biological effects, Sources, Fate

The author briefly discusses the sources, fate, and effects of marine oil pollution and emphasizes the need for long-term scientific investigation of its environmental impacts.

C-1030-78
OCEAN SCIENCE
Menard, H.W. (ed.). 1977.
San Francisco, W.H. Freeman and Company, 1977. 307p.

Environmental effects, Oil spills, Industries, Oceans

Twenty-five papers from Scientific American dealing with various aspects of marine science and technology are presented. Oil pollution is discussed in several of the articles.

C-1031-78
THE STATE OF POLLUTION OF THE MEDITERRANEAN SEA
Osterberg, C., and S. Keckes. 1977.
Ambio 6(6):321-326.

Pollution prevention, Environmental deterioration, Mediterranean Sea

A review of the pollution problems facing the Mediterranean Sea is presented. Sewage and oil appear to be the major sources of pollution.

[from Biological Abstracts 65(7):#42272. 1978]

C-1032-78
THE AMOCO CADIZ OIL SPILL
O'Sullivan, A.J. 1978.
Marine Pollution Bulletin 9(5):123-128.

Amoco Cadiz spill, Spill removal, Beach cleanup, Coasts, Biological effects, France

A preliminary account is given of the events surrounding the Amoco Cadiz spill off the Brittany coast in March 1978. Beach cleanup operations, behavior and biological effects of the oil, and preliminary conclusions are summarized.

C-1033-78
ECOLOGICAL ASPECTS OF GLOBAL SEA POLLUTION
Patin, S.A. 1977.
Oceanology 16(4):354-357.

Sources, Contamination, Oceans, Biological effects, Phytoplankton, *Rate of input

The rates of introduction of the major global pollutants, including petroleum, into the oceans are estimated and regional variations in pollutant concentrations are considered. The biological consequences of pollution, and particularly the effects on primary productivity in marine phytoplankton, are discussed.

C-1034-78
WATER POLLUTION - CAUSES AND CURES (book review)
Root, E.R. 1978.
Water, Air, and Soil Pollution 9(3):388-389.

Water quality, Sources, Industries, Lakes, Oceans, Book review

A favorable review of the title book by S.D. Morton [Wisconsin, Mirmir Publishers, Inc., 1976. 151p.] is given. [This book has been abstracted in OPR 5(1):#C-0237-78.]

C-1035-78
INTRODUCTION TO OCEANOGRAPHY
Ross, D.A. 1977.
New Jersey, Prentice-Hall, Inc., 1977. x + 438p.

Oil spills, Oceans, Tankers, Drilling

This general oceanography text includes a chapter entitled "Marine Pollution," one section of which is devoted to oil pollution.

C-1036-78
POLLUTION [English summary]
Shiba, M., H. Suzuki, S. Ohno, T. Fujita, and R. Iwai. 1977.
Sekiyu Gakkai Shi 20(4):363-369.

Pollution control, Wastewater treatment, Analytical techniques, *Review

"An over-all literature review on pollution, including air pollution, air diffusion, control measures for SO_x, NO_x, and dust from stationary and mobile sources, noise, solid wastes, water pollution, wastewater treatment, and analytical methods is reviewed with 414 references."

[from Chemical Abstracts 88(10):65212g. 1978]

C-1037-78
THE THIN EDGE: COAST AND MAN IN CRISIS
Simon, A.W. 1978.
New York, Harper & Row Publishers, 1978. xi + 180p.

Coasts, Environmental effects, Oil spills, OCS, Legislation

This book gives a general presentation of the problem of coastal pollution. A brief discussion of the effects of oil pollution on plankton is included (p. 38-39), as well as a more detailed discussion of the impact of OCS development on the coast (p. 99-112). Legislation related to oil pollution is also considered throughout the book.

C-1038-78

METALS IN NEW AND USED PETROLEUM PRODUCTS AND BY-PRODUCTS: QUANTITIES AND CONSEQUENCES
Smith, I.C., T.L. Ferguson, and B.L. Carson. 1975.
The Role of Trace Metals in Petroleum. Yen, T.F. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1975. p.123-148.

Crude oil, Waste oil, Petroleum products, Disposal, Contaminants, Health hazards, *Trace metals, *Asphalt

About 20 different metals have been identified in crude oil and petroleum products; some are natural constituents of the heavy crude fractions, others are added by people. This paper tabulates their known physiological effects on humans, animals, and plants, indicates their concentrations in waste lubricants, asphalt, and disposed petroleum products, and points out their dangers as environmental contaminants, especially of surface waters.

C-1039-78

ESTUARINE PROCESSES. VOLUME 1. USES, STRESSES, AND ADAPTATION TO THE ESTUARY
Wiley, M. (ed.). 1976.
New York, Academic Press, 1976. xvii + 541p.

Estuaries, Marshes, Sublethal effects, Marine organisms, Microorganisms, Biodegradation, *Proceedings

This is one of two volumes of papers presented at the 3rd International Estuarine Research Conference, Galveston, Texas, 1975. Oil pollution related papers are entitled "Sublethal effects of petroleum fractions on the behavior of the lobster Homarus americanus and the mud snail Nassarius obsoletus" by J. Atema, and "Microbial cycling of oil in estuarine marshland" by D.G. Ahearn, S.A. Crow, and N.H. Berger. [See OPR citations C-0169-78, and C-1544-77, respectively.]

C-1040-78

FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN MARINE ECOSYSTEMS AND ORGANISMS
Wolfe, D.A. (ed.). 1977.
New York, Pergamon Press, 1977. 478p. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Hydrocarbons, Marine organisms, Ecosystems, Biological effects, Fate, Uptake, Metabolism, *Proceedings

A total of 45 papers are presented from the title symposium on biological effects, bioaccumulation and metabolism, and distribution and movement. [Individual papers abstracted in OPR Aug 77 - Oct 77]

C-1041-78
THE ROLE OF TRACE METALS IN PETROLEUM
Yen, T.F. 1975.
Ann Arbor, Michigan, Ann Arbor Science Publishers, 1975. viii + 221p.

Crude oil, Waste oil, Petroleum products, Contaminants, Environmental effects, Health hazards, *Trace metals

This book is a collection of papers dealing primarily with the chemistry and nature of trace metals in petroleum. Contributed chapters cover trace metal geochemistry, analytical methods and related topics, with emphasis on vanadium, iron, nickel, copper and molybdenum. The environmental and health aspects of metals in crude oil and new and used petroleum products is discussed in a paper by Smith, Ferguson and Carson [this issue OPR].

D. ASPECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL ASPECTS

[No entries.]

2. PHYSICAL/CHEMICAL ASPECTS

[No entries.]

3. SOCIAL/ECONOMIC ASPECTS

C-1042-78
THE NORTH CAROLINA PETROCOMPLEX STUDY
North Carolina Department of Natural and Economic Resources. 1976.
Coastal Plains Regional Commission, Contract CPRC-10540014, Federal Energy Administration, Contract FEA-CA-12-50010-00. Final Report.
(NTIS No. PB-262 426/OST)

Oil industry, Environmental effects, Economic effects, Social effects, North Carolina, *Coastal Plains

The costs and benefits of petroleum industry development in the Coastal Plains of North Carolina are analyzed with respect to economic, social, and environmental factors.

[from Supertankers and Superports, Report NTIS/PS-77/0700:14. 1977]

4. GENERAL ASPECTS

C-1043-78
ANALYSIS OF THE ALTERNATIVES AVAILABLE FOR THE TRANSPORTATION AND DISPOSITION OF ALASKAN NORTH SLOPE CRUDE OIL. DRAFT. EXECUTIVE SUMMARY
Federal Energy Administration. 1976.
Report FEA/G-77/156. 42p.

Oil transport, Oil terminals, Environmental protection, Alaska

Transportation alternatives for Alaskan oil in excess of the West Coast demand are considered in this report. Environmental information is given in relation to construction of marine oil terminals, and various other alternatives are discussed. Also considered are pricing and foreign exchange potential.

[from Supertankers and Superports, Report NTIS/PS-77/0700:6. 1977]

C-1044-78
OFFSHORE OIL AND GAS EXTRACTION - AN ENVIRONMENTAL REVIEW
Frazier, N.A., D.L. Maase, and R. Clark. 1977.
Report EPA/600/7-77/080, Contract EPA-68-02-1323. 71p. Final report.

Environmental effects, Offshore development, Offshore drilling, Oil spills

An environmental assessment of emission sources and emissions related to US offshore oil and gas exploration, drilling, and production is reported. Greatest concern was over accidental oil spills related to drilling and production.

[from Government Reports Announcements 77(25):#PB-272 242/9GA. 1977]

C-1045-78
OFFSHORE PETROLEUM DEVELOPMENT: A PRACTICAL PERSPECTIVE
Jackson, R.D., Jr. 1977.
The Law of the Sea: Issues in Ocean Resource Management. D. Walsh (ed.). New York, Praeger Publishers, 1977. p. 226-241. (Praeger Special Studies in International Politics and Government)

Offshore development, OCS, Oil transport, International agreements, Law enforcement, Pollution control

In this essay, the author discusses the need for energy development and consequently, the need for offshore oil development. He points out that the worldwide oil pollution input from OCS drilling and production (1.3%) is far less than that from tanker transport (25%) and other sources, and that national and international legal efforts to control pollution are still largely unsatisfactory. "Two proven approaches for dealing competently and constructively with offshore oil pollution have been demonstrated by experience: voluntary industry action and joint government/industry consultation, cooperation, and action."

C-1046-78
OIL IN THE BEAUFORT AND MEDITERRANEAN SEAS
Mackay, D. 1977.
Arctic 30(2):93-100.

Oil spills, Dispersions, Biodegradation, Fate, Beaufort Sea, Mediterranean Sea

Rates of oil input, degradation, and dispersion in the title areas are discussed and compared. A simple algebraic equation is used to interrelate these parameters. It is suggested that standing oil concentrations in the Beaufort Sea may eventually equal those of the Mediterranean Sea.

[from Environmental Health and Pollution Control 13(2):#324. 1978]

C-1047-78
OCEANIC MANAGEMENT: CONFLICTING USES OF THE CELTIC SEA AND OTHER WESTERN U.K. WATERS
Sibthorp, M.M., and M. Unwin (eds.). 1977.
London, Europa Publications, 1977. 279p. Report of a Conference held at University College of Swansea, 19-22 September 1975.)

Offshore development, UK, Ports, Oil terminals, Environmental effects, Tankers, *Ocean management, *Proceedings

Papers presented at the title conference are compiled. Oil pollution relevant topics are discussed in papers by F.G. Larminie (Oil and Gas Extraction); J. Wardley Smith (Oil Exploration in the Celtic Sea: A Review of the Pollution Risk); G. Dudley (The Problems connected with the Development of a Major Oil Port in a Non-Industrial Environment); and I. Clark (Problems of Oil Development in the Shetlands). [These papers are abstracted separately in OPR 5(2).]

C-1048-78
POLLUTED GROUNDWATER: A REVIEW OF THE SIGNIFICANT LITERATURE
Todd, D.K., and D.E.O. McNulty. 1976.
New York, Water Information Center, Inc., 1976. vii + 179p.

Oil industry, Oil fields, Health hazards, Sources, Groundwater, Pollution control

This book provides a general review of the sources, evaluation, and control of groundwater pollution. Included in the chapter on industrial pollution is a section entitled "Oil Field Brines " which outlines pollution problems associated with oil production.

C-1049-78
THE LAW OF THE SEA: ISSUES IN OCEAN RESOURCE MANAGEMENT
Walsh, D. (ed.). 1977.
New York, Praeger Publishers, 1977. xi + 268p.
(Praeger Special Studies in International Politics and Government)

Resource management, Offshore production, Oil transport, Environmental effects

This book presents ten contributed essays on a wide range of international ocean policy issues related to law of the sea. Chapter 9 by R.D. Jackson, Jr. contrasts the benefits of offshore petroleum development with the environmental and pollution risks of offshore petroleum development and tanker transport [abstracted separately, this issue OPR].

C-1050-78
DEEPWATER PORTS IN THE UNITED STATES: AN ECONOMIC AND ENVIRONMENTAL IMPACT STUDY
Winters, T.L. 1977.
New York, Praeger Publishers, 1977. xiii + 199p. (Praeger Special Studies in US Economic, Social, and Political Issues)

Deepwater ports, Development, Environmental effects, Economic effects, US

The author examines the many aspects of DWP facilities and includes chapters on demand and consumption of petroleum, tankership trends, factors affecting the development of a petrocomplex, offshore environmental impacts, and onshore environmental impacts. Spill frequency for the LOOP and SEADOCK projects and accident probabilities are assessed, spill prevention and safety features are discussed, and air and water quality impacts are analyzed.

C-1051-78
MANAGING THE EARTH'S SURFACE
Woodwell, G.M. 1976.
Natural History 85(10):16-19.

Georges Bank, Fisheries, Offshore exploration, Offshore development, Resource management, Environmental effects

Georges Bank is one of the world's richest fishing areas and the spawning grounds for many of the harvested species in the northwestern Atlantic. It is also a proposed area for oil exploration and development. The author discusses the potential impact of oil development on the fishing grounds in the context of the environment as a closed system.

[from Applied Ecology Abstracts 3(11):#3D13035. 1978]

5. BASELINE AND ENVIRONMENTAL IMPACT STUDIES

C-1052-78
ROUND-THE-WORLD-NEWS: CANADA (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(6):149.

Baseline studies, Arctic Ocean, Coasts, Marine mammals, Canada

The Canadian government established an environmental research program in the arctic waters off Baffin Island before authorizing oil drilling in the region. Research will include oceanographic studies, coastline evaluation, and seal and whale surveys.

C-1053-78
DISTRIBUTION OF N-PARAFFINS IN SEA-GRASSES, BENTHIC ALGAE, OYSTERS AND RECENT SEDIMENTS FROM TERMINOS LAGOON, CAMPECHE, MEXICO
Botello, A.V., and E.F. Mandelli. 1978.
Bulletin of Environmental Contamination and Toxicology 19(2):162-170.

Baseline studies, Marine organisms, Sediments, Distribution, Biogenic hydrocarbons, Mexico, *N-paraffins

An investigation was carried out to determine the distribution of biogenic n-paraffins in the title marine organisms and sediments from the unpolluted coastal region of Terminos Lagoon, Campeche, Mexico. "The results of this study will provide a basis for the assessment of future man-induced alterations."

C-1054-78
OFFSHORE OIL IMPACT STUDIES (editorial)
Bourne, W.R.P. 1978.
Marine Pollution Bulletin 9(1):1-2.

Offshore development, Environmental effects, BLM, OCS, Baseline studies, *Editorial

The author provides a critical review of environmental assessment projects which precede offshore oil drilling. The objectives of the US BLM's Outer Continental Shelf Environmental Assessment Program begun in 1974 are listed. Several Canadian environmental impact reports on Arctic drilling are also mentioned.

C-1055-78
HYDROCARBONS IN THE WATER AND SEDIMENT OF WILDERNESS LAKE II
Brown, R.A., and P.K. Starnes. 1978.
Marine Pollution Bulletin 9(6):162-165.

Sampling, Lakes, Biogenic hydrocarbons, PAH, Canada

Baseline data on hydrocarbons was obtained from the remote Colin Scott Lake, Ontario, Canada. Sampling procedures were similar to a previously studied wilderness lake. Hydrocarbons, including PAHs, appeared to be of biogenic origin.

C-1056-78
NEWS AND COMMENT: NCC GRANTS (news brief)
Conder, P., and M. Everett. 1978.
British Birds 71(1):49.

Birds, Scotland, Ekofisk blowout, *Seabird population study

£500 was awarded the Royal Society for the Protection of Birds by the Nature Conservancy Council to complete a seabird population study in northwest Scotland. The study will provide information on the effects of the Ekofisk blowout.

C-1057-78
A PRELIMINARY ASSESSMENT OF THE ENVIRONMENTAL IMPACTS FROM OIL SHALE DEVELOPMENTS
Crawford, K.W., C.H. Prien, L.B. Baboolal, C.C. Shih, and A.A. Lee. 1977.
Report EPA/600/7-77/069, Contract EPA-68-02-1881. 189p. Report for Jul 75-Jul 76.

Baseline studies, EIS, Oil shale, Development, Pollution control, Resource management

The potential impacts on the physical environment and on the air, water, and land resources in parts of Colorado and Utah which could result from commercial oil shale development are discussed. Sources, properties, and quantities of wastes, pollution control technologies, management plans, refining hazards, and end use of shale oil products are reviewed. The major EIS and monitoring studies are identified.

[from Government Reports Announcements 77(25):#PB-272 283/3GA. 1977]

C-1058-78

SULPHUR MINES SALT DOME

Federal Energy Administration. 1977.
Report FEA/S-77/213, DES-77/6. 559p. Draft environmental impact statement.

EIS, Crude oil, Storage, FEA, Louisiana, *Salt dome, *Strategic Petroleum Reserve

This report is a site specific EIS for the proposed storage of 24 million bbls of crude oil at the Sulphur Mines salt dome in Calcasieu Parish, Louisiana. The report was prepared for FEA's Strategic Petroleum Reserve program.

[from Government Reports Announcements 77(25):#PB-272 354/2GA. 1977]

C-1059-78

ENVIRONMENTAL ANALYSIS FOR BAHAMAS SUPERTANKER PORT

Harrison, W. 1975.
Coastal Engineering Conference, 14th, Copenhagen, Denmark, 1974, Vol. 3. New York, American Society of Civil Engineers, 1975. p. 2551-2567.

Deepwater ports, Tankers, Oil spills, Environmental protection, Bahamas

Six experimental crude oil and two naphthalene spills were studied at the site chosen for construction of a supertanker bunker 48 km (30 mi) east of Freeport, Grand Bahama Island. Slick spreading rates and compositional changes in the spills are presented. The results indicate that the site is environmentally suitable for the containment of small spills.

[from Supertankers and Superports, Report NTIS/PS-77/0701:38. 1977]

C-1060-78

ESTIMATION OF AROMATIC HYDROCARBONS IN SEAWATER AT PROPOSED DEEPWATER PORT (DWP) SITES IN THE GULF OF MEXICO

Hiltabrand, R.R. 1978.
Marine Pollution Bulletin 9(1):19-21.

Baseline studies, Aromatic hydrocarbons, Seawater, Sampling, Deepwater ports, Spectroscopy, Gulf of Mexico

Over 100 water samples were collected from 3 depths at 3 proposed deepwater port sites in the Gulf of Mexico. Analysis of aromatic hydrocarbons by fluorescence spectroscopy indicated that concentrations in the water column decreased from the surface water through the water column (5 m depth) to deep water (15.5 m). The highest concentration estimate was 33.8 μg/L and the lowest was 0.6 μg/L.

C-1061-78

PETROLEUM HYDROCARBONS IN THE NORTHERN PUGET SOUND AREA--A PILOT DESIGN STUDY

MacLeod, W.D., Jr., D.W. Brown, R.G. Jenkins, L.S. Ramos, and V.D. Henry. 1977.

NOAA Technical Memorandum ERL MESA-8, EPA-600/7-77-098. vi + 53p.

Baseline studies, Sampling, Hydrocarbons, Puget Sound, Models

In anticipation of increasing tanker traffic and refining operations in Northern Puget Sound and the Strait of Juan de Fuca resulting from the operation of the Trans-Alaska pipeline, this pilot study will serve as a model for further baseline studies of the area. The results are presented and recommendations are made for a first year Petroleum Hydrocarbon Baseline Investigation.

C-1062-78

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF ANNUAL TECHNICAL SUMMARY REPORT TO THE BUREAU OF LAND MANAGEMENT FOR THE YEAR ENDING MARCH 1976

National Oceanic and Atmospheric Administration. 1976.

Report NOAA-77091604. 584p. Report for 1 Apr 75-31 Mar 76.

OCS, Environmental effects, Crude oil, Offshore development, Gulf of Alaska, Beaufort Sea, BLM

The annual executive summary is presented, followed by separate sections dealing with Lower Cook Inlet, Kodiak Island, Northeast Gulf of Alaska, Bristol Bay - St. George Basin, and the Beaufort Sea. Each section examines the local environment, pollution sources, various hazards, transport processes, and environmental effects of the various energy development activities on the Alaskan Continental Shelf.

[from Government Reports Announcements 77(26):#PB-273 210/5GA. 1977]

C-1063-78

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS. OCTOBER-DECEMBER 1976. VOLUME 1. RECEPTORS (BIOTAL): MARINE MAMMALS; MARINE BIRDS; MICROBIOLOGY

National Oceanic and Atmospheric Administration. 1977.

Report NOAA-77051112. 827p.

Baseline studies, Environmental effects, Offshore development, OCS, Marine mammals, Birds, Microorganisms, Alaska

The quarterly reports of baseline studies on the effects of petroleum development in the Alaskan Continental Shelf on the title topics are presented.

[from Government Reports Announcements 77(25):#PB-272 640/4GA. 1977]

C-1064-78
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 2. RECEPTORS (BIOTA): FISH; PLANKTON; BENTHOS; LITTORAL
National Oceanic and Atmospheric Administration. 1977.
Report NOAA-77051113. 988p.

Baseline studies, Environmental effects, Offshore development, OCS, Fish, Plankton, Benthos, Intertidal zone, Alaska

The quarterly reports of baseline studies on the effects of petroleum development in the Alaskan Continental Shelf on the title topics are presented.

[from Government Reports Announcements 77(25):#PB-272 641/2GA. 1977]

C-1065-78
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS OCTOBER-DECEMBER 1976. VOLUME 4. HAZARDS; DATA MANAGEMENT
National Oceanic and Atmospheric Administration. 1977.
Report NOAA-77051114. 582p.

Baseline studies, Environmental effects, Offshore development, OCS, Safety, Statistics, Alaska, *Hazards

The quarterly reports of baseline studies on the environmental effects of petroleum development in the Alaskan Continental Shelf are presented. This volume covers man-made and natural hazards, data management, and program coordination.

[from Government Reports Announcements 77(25):#PB-272 642/0GA. 1977]

C-1066-78
OCS OIL AND GAS: AN ASSESSMENT OF THE DEPARTMENT OF THE INTERIOR ENVIRONMENTAL STUDIES PROGRAM
National Research Council. Committee to Evaluate Outer Continental Shelf Environmental Studies. 1978.
Washington, D.C., National Academy of Sciences, 1978. xiv + 109p.

OCS, Oil-gas leasing, Environmental effects, Development, BLM, *Environmental Studies Program

At the Request of the Bureau of Land Management, the Committee to Evaluate Outer Continental Shelf Environmental Studies was appointed to evaluate the Environmental Studies Program on OCS development which provides data to aid the Department of the Interior in decisions concerning leasing of OCS areas for oil and gas exploration and development. The committee's findings indicate that "the Program has not been based on an adequate assessment and identification of the scientific research that is required to answer environmental concerns for oil and gas operations." Recommendations for revisions in the Program are detailed.

C-1067-78
ENVIRONMENTAL IMPACT OF A SUPERPORT IN THE GULF OF MEXICO
Stone, J.H. 1975.
National Conference on Complete Water Reuse, 2nd, Water's Interface with Energy, Air and Solids, Chicago, Illinois, 1975.
New York, American Institute of Chemical Engineers, 1975. p. 1217-1229.

Deepwater ports, Gulf of Mexico, Environmental effects

The environmental impact of building and operating a superport in the Gulf of Mexico is discussed.

[from Supertankers and Superports, Report NTIS/PS-77/0701:3. 1977]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-1068-78
ONE BUG'S POISON IS ANOTHER BUG'S FOOD
Anon. 1978.
Sun Magazine 43(2):25.

Biodegradation, Waste oil, Disposal, Soil, Bacteria, *Biodisposal farming

Sponsored by American Petroleum Institute research grants, Suntech, Inc. scientists are conducting field studies into "biodisposal farming" as a method of disposing of oily wastes from refineries. Using this method, oily wastes are carefully distributed on farm land sites, provided with nutrients to aid bacterial degradation, and tilled frequently to assure oxygenation. The process is claimed to convert most oily wastes to CO_2 and water, in an environmentally acceptable manner.

C-1069-78
PRUDHOE CRUDE OIL IN ARCTIC MARINE ICE, WATER, AND SEDIMENT ECOSYSTEMS: DEGRADATION AND INTERACTIONS WITH MICROBIAL AND BENTHIC COMMUNITIES
Atlas, R.M., A. Horowitz, and M. Busdosh. 1978.
Journal of the Fisheries Research Board of Canada 35(5):585-590.

Biodegradation, Crude oil, Microorganisms, Benthos, Invertebrates, Mortality, Arctic, *Recolonization

Experimental miniature oil spills were used in situ to simulate polluted conditions in the arctic environment. The degradation of the oil, oil-degrading microbial populations, and effect on benthic invertebrates were studied. Biodegradation was found to be very slow. Benthic invertebrates died after contamination, and the composition of benthic communities two months after recolonization began was significantly different from the control.

C-1070-78
METHOD AND APPARATUS FOR MICROBIAL DEGRADATION OF CRUDE PETROLEUM, OIL FRACTIONS, AND DIFFERENT ORGANIC CONTAMINATION PRODUCTS
Azarowicz, E.N. 1977.
French Demande 2,320,912

Biodegradation, Petroleum products, Microorganisms, Patent, *Nutrients

"Petroleum pollutants and oil residues are biodegraded by adding nutrients to an aqueous mixture of the wastes and then adding the microorganisms. The mixture is aerated and agitated. Suitable microorganisms include Candida sp., Penicillium sp., Nocardia sp., and Saccharomyces cerevisiae."

[from Chemical Abstracts 88(12):#78686q. 1978]

C-1071-78
MICROBIAL ECOLOGY STUDIES OF THE METULA SPILL IN THE STRAIT OF MAGELLAN
Colwell, R.R., A. L. Mills, J.D. Walker, P. Garcia-Tello, and V. Campos-P. 1978.
Journal of the Fisheries Research Board of Canada 35(5):573-580.

Biodegradation, Microorganisms, Bacteria, Weathering, Metula spill, Strait of Magellan

The effects of the Metula oil spill on the microorganisms in the Strait of Magellan were studied in situ. An increase in the number of bacteria was found in the spill region. Oil was degraded slowly by microorganisms, probably because of limitations in the available nitrogen and phosphorus, and because of the formation of aggregations and tar balls that rendered the oil inaccessible to biodegradation.

C-1072-78
SOME MAJOR DEVIATIONS FOR BIOMASS DETERMINATION BY INDIRECT METHOD AND ESTIMATION BASED ON ALKALI COMSUMPTION
Concone, B.R.V., P.A. Doin, and A.G. Pinto. 1978.
Journal of Fermentation Technology 56(1):59-63.

Biodegradation, Biomass, Microorganisms, Fuel oil, pH control, *Deviations, *Alkali consumption

"Some factors like the variation of the liquid volume, the variation of cellular N content, and the mass of cells taken with the samples during batch cultivation of microorganisms on diesel oil were considered for the computation of the ratio between cell mass produced and the mass of alkali consumed to maintain the pH of the fermentation medium." [possibly oil pollution related]

[from Chemical Abstracts 88(21):#150544m. 1978]

C-1073-78
MICROBIAL CATABOLISM, THE CARBON CYCLE AND ENVIRONMENTAL POLLUTION
Dagley, S. 1978.
Naturwissenschaften 65(2):85-95.

Biodegradation, Microorganisms, *Carbon cycle

"A review with 63 references." [possibly oil pollution related]

[from Chemical Abstracts 88(17):#117454j. 1978]

C-1074-78
OIL POLLUTION
Dart, R.K., and R.J. Stretton. 1977.
Microbiological Aspects of Pollution Control. R.K. Dart and R.J. Stretton. Amsterdam, Elsevier Scientific Publishing Co., 1977. p. 180-192.

Biodegradation, Microorganisms, Bacteria, Fungi, Yeasts, Hydrocarbons

Chapter 10 of this book reviews the microbiological aspects of oil pollution. The types of microorganisms capable of degrading oil, the role of microorganisms in hydrocarbon degradation under various conditions, and the chemical pathways for the biodegradation of hydrocarbons are discussed.

C-1075-78
ECOLOGICAL STUDIES ON HYDROCARBON-OXIDIZING BACTERIA IN JAPANESE COASTAL WATERS - II. DISTRIBUTION OF HYDROCARBON-OXIDIZING BACTERIA IN THE OIL-POLLUTED AREAS CAUSED BY THE MIZUSHIMA OIL REFINERY ACCIDENT [English summary]
Fujisawa, H., M. Murakami, and T. Manabe. 1978.
Nippon Suisan Gakkaishi. Bulletin of the Japanese Society of Scientific Fisheries 44(2):91-104.

Biodegradation, Bacteria, Distribution, Hydrocarbons, Japan, *Bisan Seto

A study was conducted over a one-year period on the distribution of hydrocarbon utilizing bacteria in Bisan Seto, the site of a 1974 spill from the Mizushima Oil Refinery in Japan. The density of these bacteria was higher in water and sediments of Bisan Seto than in a non-polluted area.

C-1076-78
STUDY OF THE TOXICITY AND BIODEGRADATION OF TWO PETROLEUM EFFLUENTS USING RECONSTITUTED MARINE FOOD CHAINS [in French]
Gauthier, M.J., and R.L. Clement. 1977.
Tribune du CEBEDEAU 30(409):457-466.

Biodegradation, Toxicity, Wastewaters, Marine organisms, Yeasts, Activated sludge, Food web

"A fermentation effluent containing organic material, minerals (phosphates), yeast, and 0.5-1.0 g gas oil/L was much less toxic to the marine organisms (zooplankton, mollusk, fish) tested than its centrifugation liquid containing ~10 g gas oil/L and 1 g detergent/L. The toxicity of the effluents was not altered following biodegradation by marine bacteria, but was decreased after degradation by activated sludge."

[from Chemical Abstracts 88(19):#131572c. 1978]

C-1077-78
USE LAND FARMING FOR OILY WASTE DISPOSAL
Grove, G.W. 1978.
Hydrocarbon Processing 57(4):138-140.

Biodegradation, Sludge, Refineries, Soil, Disposal, Incineration, *Land farming

The advantages of land farming for disposal of oily refinery sludges over landfilling or incineration are discussed.

C-1078-78
MICROORGANISM FUNCTIONING IN WATER ECOSYSTEMS: I. MICROBIOLOGICAL BREAKDOWN OF PETROLEUM PRODUCTS IN THE ARCTIC OCEAN [in Russian]
Gusev, M.V., O. Yu. Sentsova, T.V. Koronelli, V.V. Il'inskii, and V.D. Fedorov. 1977.
Biologicheskie Nauki 20(8):110-119.

Biodegradation, Bacteria, Microorganisms, Hydrocarbons, Arctic Ocean

Hydrocarbon-consuming microorganisms from the Arctic Ocean were studied. A distribution study indicated that their numbers corresponded to the level of oil pollution. Petroleum oxidation was found to be dependent upon the presence of nitrogen sources.

[from Biological Abstracts 65(9):#52190. 1978]

C-1079-78
CRUDE OIL DEGRADATION IN THE ARCTIC: CHANGES IN BACTERIAL POPULATIONS AND OIL COMPOSITION DURING ONE-YEAR EXPOSURE IN A MODEL SYSTEM
Horowitz, A., and R.M. Atlas. 1978.
Developments in Industrial Microbiology, Volume 19. E.A. Underkofler (ed.). Washington, D.C., Society for Industrial Microbiology, 1978. p. 517-522.

Biodegradation, Microorganisms, Arctic, Crude oil

Changes in oil composition and microbial populations were examined in experimental Arctic oil spills over a 1-yr period beginning in the summer. After the first 2 weeks, an 18% weight loss of the oil had occurred due to abiotic factors, and the numbers of microorganisms had increased in both fertilized and unfertilized oil. At the end of the summer (70 days), 75% of unfertilized and 60% of fertilized oil remained. No biodegradation occurred during the winter. The relative composition of all the oil remained the same after the initial abiotic losses.

C-1080-78
THE MICROBIAL DEGRADATION OF OIL IN THE SEA
Hughes, D.E., and P. McKenzie. 1975.
Proceedings of the Royal Society of London, Series B 189(1096): 375-390.

Biodegradation, Crude oil, Hydrocarbons, Microorganisms, Dispersants, Tar

From the moment oil is spilled into the sea, microbial degradation begins to take place. In laboratory and field studies about 40-90% of the oil is found to degrade. Alkanes and saturated compounds are degraded first, followed by aromatic and heterocyclic compounds. Sinking agents and dispersants may influence the rate and pattern of degradation. A major problem pointed out is that of the persistent tar balls. These lumps of oil have, by various natural processes, become so coated with residual hydrocarbons and detritus that they are virtually inert to microbial attack.

C-1081-78
BIOLOGICAL FEATURES OF SOME SEA BACTERIA [English summary]
Krivitskaya, T.N., V.P. Tul'chineskaya, L.L. Zhitetskaya, and L.V. Moiseeva. 1977.
Mikrobiologichnii Zhurnal (Kiev) 39(5):645.

Biodegradation, Bacteria, Petroleum products, Seawater

"Sixty strains of bacteria were separated from seawater and examined as to their ability to oxidize motor oil, solar oil, and HCHO. Of the separated cultures, 90% could biodegrade these materials at 1 mg/L concentration; 20% could biodegrade the HCHO at >1 mg/L concentration and 10%, at 500 mg/L concentration."

[from Chemical Abstracts 88(6):#41475u. 1978]

C-1082-78
METABOLISM OF HYDROCARBONS IN MARINE INVERTEBRATES: ARYL HYDROCARBON HYDROXYLASE FROM THE TISSUES OF THE BLUE CRAB CALLINECTES SAPIDUS AND THE POLYCHAETE WORM, NEREIS SP.
Lee, R.F., E. Furlong, and S. Singer. 1977.
Pollutant Effects on Marine Organisms. C.S. Giam (ed.). Lexington, Massachusetts, Lexington Books, 1977. p. 111-124.

Biodegradation, Hydrocarbons, Metabolism, Crustaceans, *Callinectes sapidus, Polychaetes, *Nereis sp., *Aryl hydrocarbon hydroxylase

Aryl hydrocarbon hydroxylase (AHH), an enzyme complex which acts to detoxify foreign organic compounds, has been found in the tissue of the title crustacean and polychaete. This paper reports the results of experiments on the isolation and characterization of this enzyme complex. In the crab, AHH was associated primarily with the green gland, with lesser activity in the gill, hepatopancreas and blood. The polychaete had most of its AHH activity in the intestine, with little or no activity in the pharynx, esophagus, or stomach.

C-1083-78

CODIFICATION OF PETROLEUM HYDROCARBON UTILIZING MICROORGANISMS
Lonsane, B.K., H.D. Singh, and J.M. Baruah. 1975.
Journal of Scientific and Industrial Research 34(11):614-624.

Biodegradation, Microorganisms, Hydrocarbons, Bacteria, Yeasts, Fungi, *Review

"The microorganisms known to be capable of utilizing various hydrocarbons are listed and classified on the basis of the type and nature of the substrates." Included are 277 references.

C-1084-78

METABOLISM OF AROMATIC HYDROCARBONS IN MARINE ORGANISMS
Malins, D.C. 1977.
Annals of the New York Academy of Sciences Vol. 298:482-496. Proceedings.

Biodegradation, Aromatic hydrocarbons, Marine organisms, Metabolism, Oxidation, *Enzyme systems

A review is presented of the current understanding of hydrocarbon metabolism in marine life, "particularly with respect to the enzyme systems involved and the nature of the products formed." In an assessment of needed research, the author stresses that work on the metabolism of aromatic petroleum hydrocarbons has largely neglected the products of photochemical and biological oxidation which occur in the marine environment

C-1085-78

THERMOPHILIC HYDROCARBON-CONSUMING BACTERIA: ISOLATION AND PHYSIOLOGICAL PROPERTIES [English summary]
Mikhaleva, V.V., L,K. Kruchinina, and R.A. Mel'nik. 1976.
Prikladnaya Biokhimiya i Mikrobiologiya 12(5):654-659.

Biodegradation, Bacteria, Hydrocarbons, Growth

Four strains of thermophilic hydrocarbon-consuming spore-forming bacteria were isolated from soil cultures. They were grown on liquid media containing hydrocarbons. "The growth on the liquid mineral medium containing paraffins and oil distillates as C and energy sources occurred only in the presence of organic substances, e.g., peptone, yeast autolysate, corn extract, glucose, starch and soybean flour. The highest increase in biomass occurred upon peptone addition."

[from Biological Abstracts 65(4):#23138. 1978]

C-1086-78

OCEANIC MICROORGANISMS INGESTING PETROLEUM OIL: ITS INDUSTRIAL APPLICATION [in Japanese]
Murakami, A. 1977.
Kagaku To Seibutsu 15(12):780-781.

Biodegradation, Bacteria, Spill cleanup

"A review [is presented] with 6 references on the application of petroleum-assimilating bacteria to the clearance of sea water pollution."

[from Chemical Abstracts 88(17):#117443e. 1978]

C-1087-78

THE EFFECT OF NUTRIENT APPLICATION AND AERATION ON OIL DEGRADATION IN SOIL
Odu, C.T.I. 1978.
Environmental Pollution 15(3):235-240.

Biodegradation, Soil, Crude oil, *$(NH_4)_2SO_4$, *Nutrients, *Aeration

The effects of $(NH_4)_2SO_4$, nutrients, and aeration on the degradation of oil in soil polluted with Nigerian crude oil were studied. No effect was found after four weeks of incubation. Oil degradation in nutrient- and $(NH_4)_2SO_4$-treated and aerated soil was enhanced after 12 weeks in the less polluted soil ("5% pollution") but not in the more polluted (10%). Oxygen consumption in polluted soil was: a) greater than in unpolluted soil, b) depressed with addition of $(NH_4)_2SO_4$, and c) increased with addition of $(NH_4)_2SO_4$ and nutrients.

C-1088-78

FERMENTATION CHARACTERISTICS AND BIOCHEMICAL REACTIONS OF SOME ORGANISMS ISOLATED FROM OIL-POLLUTED SOILS
Odu, C.T.I. 1978.
Environmental Pollution 15(4):271-276.

Biodegradation, Hydrocarbons, Microorganisms, Bacteria, Yeasts, Fungi, Soil

Biodegradation of oil in soils isolated from oil-producing and non-oil-producing areas was studied. The microorganisms present in each of the two soils were isolated. Both soils were found to contain microorganisms (bacteria, yeast and fungi) capable of attacking petroleum hydrocarbons. Bacterial isolates were also tested for their ability to grow on nitrogen-free medium and for their fermentation characteristics.

C-1089-78

OIL DEGRADATION AND MICROBIOLOGICAL CHANGES IN SOILS DELIBERATELY CONTAMINATED WITH PETROLEUM HYDROCARBONS
Odu, C.T.I. 1977.
Institute of Petroleum Technical Paper IP 77-005. 11p.

Biodegradation, Bacteria, Fungi, Microorganisms, Soil, Hydrocarbons

"Results of a field experiment on oil disappearance in a sandy loam contaminated with 0,1,2,5, and 10 kg/m^2, with and without fertilizer application, as well as changes in total bacterial numbers, total fungi, aerobic N fixers, and nitrifiers, are presented."

[from Chemical Abstracts 88(15):#103823s. 1978]

C-1090-78

BENEFICIAL STIMULATION OF BACTERIAL ACTIVITY IN GROUNDWATERS CONTAINING PETROLEUM PRODUCTS
Raymond, R.L., V.W. Jamison, and J.O. Hudson. 1977.
AIChE Symposium Series 73(166):390-404.

Biodegradation, Bacteria, Gasoline, Groundwater, Contamination

"Aeration and addition of $(NH_4)_2SO_4$ and NaH_2PO_4 to gasoline-contaminated ground water in a limestone aquifer increased the numbers of naturally occurring gasoline utilizing bacteria, i.e., Nocardia, Pseudomonas, Acinetobacter, Flavobacterium and Micrococcus."

[from Chemical Abstracts 88(10):#65539u. 1978]

C-1091-78

PERSISTENCE OF OIL IN TUNDRA SOILS
Sexstone, A.J., and R.M. Atlas. 1978.
Developments in Industrial Microbiology, Volume 19. E.A. Underkofler (ed.). Washington, D.C., Society for Industrial Microbiology, 1978. p. 507-515.

Biodegradation, Microorganisms, *Tundra, Natural seepage, Alaska

Biodegradation of experimental Prudhoe crude oil spills in tundra soils was studied over 4 and 5 yr periods. Numbers of oil-degrading microorganisms were higher in sites with concentrations of 5 and 12 L/m^2 oil than in unoiled soils after 1 and 4 yrs. At 20 and 25 L/m^2, and at the site of a natural seep, the numbers were generally lower than controls after 4 yrs. N-paraffins were degraded more readily in the 5 and 12 L/m^2 spills than in the 20 and 25 L/m^2 spills where they persisted in significant concentrations after 5 yrs.

C-1092-78
INTERNATIONAL BIODEGRADATION SYMPOSIUM, 3RD, KINGSTON, RHODE ISLAND, USA, AUGUST 17-23, 1975
Sharpley, J.M. and A.M. Kaplan (eds.). 1976.
London, Applied Science Publishers Ltd., 1976. xiv + 1138p.

Biodegradation, Hydrocarbons, Fuel oil, Metabolism, Lubricating oil, *Proceedings

The proceedings were grouped into 25 sessions; the topic of one session was metabolism of hydrocarbons, oils, fuels, and lubricants.

[from Biological Abstracts 65(6):#33292. 1978]

C-1093-78
THE MICROBIAL DEGRADATION OF OIL IN CONTINUOUS CULTURE IN FRESHWATER ECOSYSTEMS
Ventullo, R.M. 1975.
New York State Assembly. Albany, N.Y. 79p.

Biodegradation, Freshwater, Ecosystems, Microorganisms, Oil slicks, *Continuous culture

Continuous flow systems were developed in the laboratory to simulate oil slick conditions in a freshwater environment, using topped diesel oil placed on 150 ml of fresh Lake Ontario water. The oil layer eventually became impregnated with bacteria and was slowly removed; complete removal generally occurred within 120 days.

[from Chemical Abstracts 87(22):#172665h. 1977]

C-1094-78
EFFECTS OF MICROBIAL ACTIVITY ON AQUATIC POLLUTANTS
Voll, M.J., J. Isbister, L. Isaki, M. McCommas, and R.R. Colwell. 1977.
Annals of the New York Academy of Sciences Vol. 298:104-110. Proceedings.

Biodegradation, Microorganisms, Carcinogens, Seawater, Sediments, Chesapeake Bay, Crankcase oil

"A petroleum fraction subjected to microbial degradation produced no carcinogens detectable in the Ames Salmonella/liver microsome system. Several mixted cultures from Chesapeake Bay water and sediment were incubated with 1% motor oil in a salts medium. The negative result contrasts with a tentative finding of mutagenic compounds in the oil-polluted waters and sediments from which the microorganisms were recovered."

[from Chemical Abstracts 88(5):#34251q. 1978]

2. PHYSICAL/CHEMICAL CHANGES

C-1095-78
FLOCCULATION BEHAVIOR OF SUSPENDED SEDIMENTS AND OIL EMULSIONS
Bassin, N.J., and T. Ichiye. 1977.
Sedimentary Petrology 47(2):671-677.

Flocculation, Sedimentation, Emulsions, Adsorption, Coagulation, *Colloids

This study indicates that clay particles and oil emulsions in fresh and brackish waters form spontaneous association colloids or colloid electrolytes in the presence of dissolved salts. Oil sedimentation in marine areas may be caused by the colloidal flocculating abilities of the dissolved salts rather than by inherent coagulation properties of oils and suspended clay particles.

[from Aquatic Sciences and Fisheries Abstracts, Part I 8(1):#723-1Q8. 1978]

C-1096-78
AN EXPLORATORY STUDY OF THE BEHAVIOR OF CRUDE OIL SPILLS UNDER ICE
Greene, G.D., P.J. Leinonen, and D. Mackay. 1977.
Canadian Journal of Chemical Engineering 55(6):696-700.

Behavior, Oil slicks, Ice, Freshwater, Solution, Spill cleanup

A small experimental spill of crude oil under the ice cover of a fresh water pond with an underwater viewing port is described. Some oil recovery and spill disposal methods were tested, and dissolved hydrocarbon concentrations and oil slick behavior were monitored. The oil slick adopted a thickness of about 2 cm under the ice.

[from Chemical Abstracts 88(8):#54895f. 1978]

C-1097-78
EVAPORATION RATES OF COMPLEX HYDROCARBON MIXTURES UNDER ENVIRONMENTAL CONDITIONS
Nadeau, J.S., and D. Mackay. 1978.
Spill Technology Newsletter 3(2):42-55.

Petroleum products, Fuels, Crude oil, Evaporation, Models, *Equations

Equations and charts are presented, which enable calculation of the evaporation of petroleum products (fuel oils, gasoline, diesel fuels, and certain crude oils) from a knowledge of the product volatility, wind speed, temperature, and spill thickness and area.

C-1098-78

MECHANICAL DISPERSAL OF OIL STRANDED IN THE LITTORAL ZONE
Owens, E.H. 1978.
Journal of the Fisheries Research Board of Canada 35(5):563-572.

Dispersions, Weathering, Intertidal zone, *Mechanical energy

A review is presented of the effects of mechanical energy on the weathering and dispersion of oil stranded in the littoral zone. Sources of mechanical energy include wind, waves, tides, water levels, and ice.

C-1099-78

THE SPREADING OF CRUDE OIL SPILLS ACROSS A LAKE
Phillips, C.R., and V.M. Groseva. 1977.
Water, Air, and Soil Pollution 8(3):353-360.

Oil slicks, Spreading, Movement, Evaporation, Crude oil, Lakes

The spreading of two experimental crude oil spills on lakes in the Mackenzie River delta in Canada was studied. The spreading velocities ranged from 3-16% of the wind velocity. Gas chromatographic analysis indicated that compositional changes in the slicks were due to evaporation of the volatile components. One of the slicks (Norman Wells crude oil) displayed two spreading fronts with the surface slick spreading at a greater velocity than the bulk.

C-1100-78

PHYSICAL PROCESSES FOR POLLUTANT TRANSPORT IN THE WATER ENVIRONMENT
Rumer, R.R. 1977.
Fate of Pollutants in the Air and Water Environments. Part 1. Mechanism of Interaction Between Environments and Mathematical Modeling and the Physical Fate of Pollutants. I.H. Suffet (ed.). New York, John Wiley & Sons, 1977. p. 297-321.

Fate, Models, Behavior, Movement, Dispersions

"The fate of most pollutants is dependent upon physical processes associated with the hydrodynamic behavior of the water body. This paper has attempted to outline these physical processes according to water body type." [possibly oil pollution related]

3. GENERAL FATE

C-1101-78
LONG-TERM FATE OF PETROLEUM HYDROCARBONS AFTER SPILLS - COMPOSITIONAL CHANGES AND MICROBIAL DEGRADATION
Butler, J.N., and E.M. Levy. 1978.
Journal of the Fisheries Research Board of Canada 35(5):604-605.

Biodegradation, Weathering, Fate, Recovery, *Symposium summary

This paper presents a summary and overview of Session I of the Symposium on Recovery Potential of Oiled Marine Northern Environments. "Session I, which dealt with the long-term changes in the composition of oil when it is exposed to the marine environment, clearly demonstrated that the potential for recovery exists but may take many years."

C-1102-78
MARINE CHEMISTRY IN THE COASTAL ENVIRONMENT
Church, T.M. (ed.). 1975.
Washington, D.C., American Chemical Society. 1975. x + 710p.
(ACS Symposium Series, No. 18)

Distribution, Biodegradation, Fate, Hydrocarbons, Chemical analysis, Sediments, Seawater, *Proceedings

Presented are the proceedings of the title symposium which was held at the 169th meeting of the American Chemical Society, Philadelphia, Pennsylvania, April 8-10, 1975. Included are the following oil pollution-related papers: Origin and Distribution of Low Molecular Weight Hydrocarbons in Gulf of Mexico Coastal Waters (W.M. Sacket, and J.M. Brooks); Genesis and Degradation of Petroleum Hydrocarbons in Marine Environments (T.F. Yen); and A Comparison of Analysis Methods for Hydrocarbons in Surface Sediments (J.W. Farrington, and B.W. Tripp).
[See OPR May-July 1976:#C-1270-76, C-1713-76, and C-1291-76.]

C-1103-78
DISTRIBUTION OF TAR BALLS ON BAHAMIAN BEACHES
Coakley, J.P. 1977.
Shore and Beach 45(2):31-35.

Tar, Distribution, Sampling, Beaches, Bahamas

The occurrence of tar balls, rounded masses of semi-solid petroleum residue, is quantified on beaches of Grand Bahama Island. A total of 48 samples were taken at 17 selected sites. An estimated 50 tar balls/m^2 were distributed along the south coast. Various factors which may control tar ball distribution were discussed.

C-1104-78
THE FATE OF FOSSIL FUEL HYDROCARBONS IN MARINE ANIMALS
Corner, E.D.S. 1975.
Proceedings of the Royal Society of London, Series B 189(1096): 391-413.

Hydrocarbons, PAH, Sources, Uptake, Release, Marine organisms, Food web, Biodegradation

Certain petroleum hydrocarbons have been detected in marine invertebrates, vertebrates, and phytoplankton. The importance of pollution as a source of these hydrocarbons, and the evidence for their biosynthesis in marine organisms are considered. Discussed also is the evidence for the transfer of PAHs through the marine food web, and the question of whether they are excreted unchanged or as metabolites, based on studies made of their fate in animals.

C-1105-78
LONG-TERM FATE OF A HEAVY FUEL OIL IN A SPILL CONTAMINATED B.C. COASTAL BAY
Cretney, W., C.S. Wong, D.R. Green, and C. Bawden. 1978.
Journal of the Fisheries Research Board of Canada 35(5):521-527.

Fuel oil, Hydrocarbons, Chromatography, Biodegradation, Fate, Source identification, Bays, Canada, *Pentacyclic triterpanes

The fate of accidentally spilled No. 5 fuel oil in a small coastal bay in British Columbia was observed over four years using GC. Lower molecular weight components were lost primarily by dissolution and evaporation, n-alkanes were almost completely removed within the first year by biodegradation, and pristane and phytane were biodegraded almost completely within four years. Pentacyclic triterpanes were extremely resistant to degradation and may be useful for the long-term source identification of oil spills.

C-1106-78
AROMATIC HYDROCARBONS: DISTRIBUTION AND POSSIBLE FATE IN THE ENVIRONMENT
Gibson, D.T. 1977.
Pollutant Effects on Marine Organisms. C.S. Giam (ed.). Lexington, Massachusetts, Lexington Books, 1977. p. 38.

Aromatic hydrocarbons, Sources, Distribution, Fate, Biodegradation

Aromatic hydrocarbons find their way into the environment from many sources: natural seepage, spillage and weathering of fossil fuels and their refined products, diagenesis, and pyrolysis at intermediate and high temperatures. The chemical and biological degradation of these hydrocarbons in nature are briefly reviewed.

C-1107-78
POLLUTION HISTORY OF ESTUARINE SEDIMENTS
Goldberg, G.D. 1976.
Oceanus 19(5):18-26.

Fate, Models, Fossil fuels, Sediments, Estuaries, Contaminants

In order to ascertain the amount of a pollutant entering a deposit per unit of time, the age of the strata must be determined. The effects of hurricanes, earthquakes, radioactive fallout, fossil fuel and industrial activity are discussed. The general fate of pollutants in the environment is described. [possibly oil pollution related]

[from Applied Ecology Abstracts 3(9):#3D10715. 1977]

C-1108-78
IMPORTANCE OF SEDIMENT WORKING BY THE DEPOSIT-FEEDING POLYCHAETE *ARENICOLA MARINA* ON THE WEATHERING RATE OF SEDIMENT-BOUND OIL
Gordon, D.C., Jr., J. Dale, and P.D. Keizer. 1978.
Journal of the Fisheries Research Board of Canada 35(5):591-603.

Weathering, Sediments, Polychaetes, Biological effects, **Arenicola marina*

The effects of sediment-bound oil on the polychaete *Arenicola marina*, and the effect of the sediment-working activity of these worms on the weathering rate of sediment-bound oil were investigated. The activity of the worms did appear to enhance the weathering rate when oil concentrations in the sediments were within a range the worms could tolerate.

C-1109-78
RESIDUES OF BUNKER C OIL IN CHEDABUCTO BAY, NOVA SCOTIA, 6 YEARS AFTER THE *ARROW* SPILL
Keizer, P.D., T.P. Ahern, J. Dale, and J.H. Vandermeulen. 1978.
Journal of the Fisheries Research Board of Canada 35(5):528-535.

Fate, Sediments, Fuel oil, Intertidal zone, Chedabucto Bay, **Arrow* spill

In 1970, the *Arrow* spill oiled about half of the 600 km shoreline of Chedabucto Bay, Nova Scotia. Field studies in 1976 have identified a few isolated areas of stranded oil, mixed with sediment to form pavement-like material. Oil was not detected in most sub-littoral sediments of the Bay but was found mixed with surficial sand and gravel of some intertidal locations, and also was found in some inshore areas. Continued chronic oil pollution of some of the areas originally contaminated make a calculation of the exact amount of *Arrow* Bunker C oil remaining in Chedabucto Bay impossible.

C-1110-78

GLOBAL DISTRIBUTION OF CARCINOGENIC POLLUTANTS IN WATER
Kraybill, H.F. 1977.
Annals of the New York Academy of Sciences Vol. 298:80-89. Proceedings.

PAH, Carcinogens, Contaminants, Sources, Distribution, Health hazards, Metabolism

Briefly reviewed are the sources, occurrences and worldwide distribution of toxic or carcinogenic organic substances, including petroleum-derived PAHs. The long-term effects of low levels of contaminants and their potential accumulation and transfer in the marine food chain is discussed.

C-1111-78

FATE OF OIL AND EFFECTS ON MARINE LIFE
Lasday, A.H., and E.W. Mertens. 1976.
Journal of Petroleum Technology 28(November):1285-1288.

Marine organisms, Contamination, Offshore drilling, Biological effects, Fate, Shorelines

Results of an API research program indicate that oil spilled in an offshore-platform mishap becomes relatively inert before it reaches the most biologically sensitive shoreline.

C-1112-78

WEATHERING CHARACTERISTICS OF PETROLEUM HYDROCARBONS DEPOSITED IN FINE CLAY MARINE SEDIMENTS, SEARSPORT, MAINE
Mayo, D.W., D.S. Page, J. Cooley, and E. Sorenson, et al. 1978.
Journal of the Fisheries Research Board of Canada 35(5):552-562.

Fate, Chemical analysis, Weathering, Sediments, Sampling, Maine, *Mya arenaria*

Sediment samples from Long Cove, Searsport, Maine, the site of a 1971 oil spill, were collected and analyzed for petroleum residues. Weathering of the residues in the cold anoxic clay sediments is taking place at a very slow rate for some of the sampling sites. "Repopulation of the Cove by [the clam] *Mya arenaria*, which is proceeding very slowly, correlates directly with the gross concentration variations of petroleum hydrocarbons."

C-1113-78

DETERMINATION OF OIL AND PHENOL IN COASTAL SEA WATER AND BIOLOGICAL DECOMPOSITION OF PHENOL BY MICROFLORA OF MARINE SEDIMENTS [English summary]
Munjko, I., and M. Mandic. 1976.
Vodoprivreda 8(40-41):55-60.

Sampling, Intertidal zone, Biodegradation, Microorganisms, Aromatic hydrocarbons, Yugoslavia

The intertidal zone of the Istrian and Dalmatian coast and some islands are more polluted with oils and phenols in spring than in autumn. Phenol concentrations >10 mg/L were determined in samples from 15 sites; oil concentrations were between 0.20 and 12.8 mg/L. Biodegradation of phenols by the microflora of marine sediments readily occurs. During biodegradation the total number of microorganisms increases significantly and is higher at higher phenol concentrations.

[from Chemical Abstracts 88(20):#141318p. 1978]

C-1114-78

WHAT BECAME OF THE OIL FROM THE "ARGO MERCHANT"? [in German]
Olbrueck, G. 1977.
Khira 114(9):859-863.

Fate, Argo Merchant spill, Behavior, North Sea, Spill cleanup

The fate of the oil spilled from the Argo Merchant into the North Atlantic is discussed and tables and graphs are presented. The data is used to estimate the direction of spill extension in the event of an oil spill in the North Sea. Methods for cleanup are also reviewed.

[from Environmental Health & Pollution Control 13(1):#104. 1978]

C-1115-78

KINETICS OF CHEMICAL PROCESSES FOR THE SELF-PURIFICATION OF SEA WATER BY THE REMOVAL OF DISSOLVED HYDROCARBONS OF PETROLEUM ORIGIN [English summary]
Ryabinin, A.I., and Yu. A. Afanas'ev. 1977.
Okeanologiya 17(5):824-828.

Oil spills, Evaporation, Biodegradation, Seawater, *Kinetics

"Equations describing the kinetics of evaporation and microbiological oxidation of spilled petroleum hydrocarbons during the self-cleaning of seawater are given."

[from Chemical Abstracts 88(8):#52703t. 1978]

C-1116-78

FATE OF POLLUTANTS IN THE AIR AND WATER ENVIRONMENTS. PART I. MECHANISM OF INTERACTION BETWEEN ENVIRONMENTS AND MATHEMATICAL MODELING AND THE PHYSICAL FATE OF POLLUTANTS
Suffet, I.H. 1977.
New York, John Wiley & Sons, 1977. xx + 484p.

Fate, Models, Sea surface, Hydrocarbons

A collection of papers on the title subjects is presented. Pollutants discussed include heavy metals, phthalates, hydrocarbons, humic acids, and pesticides. Papers relevant to oil pollution include "The Air-Water Interface: Particulate Matter Exchange Across the Air-Water Interface," by J.W. Winchester and R.A. Duce [abstracted separately in this issue of OPR], and "Transfer of Organics from an Oil Film Into Water," by I. Lysyj and E.C. Russell [abstracted previously in OPR Aug-Oct 1977].

C-1117-78

COMPOSITION AND SOURCES OF POLLUTANT HYDROCARBONS IN THE SEVERN ESTUARY
Thompson, S., and G. Eglinton. 1978.
Marine Pollution Bulletin 9(6):133-136.

Crude oil, PAH, Sediments, Sources, Estuaries, UK

Examined hydrocarbons from sediments in the Severn Estuary were mostly pollutants from crude oils. Sediment-accumulated PAHs, including the carcinogen benzo(a)pyrene, are probably derived from combustion products.

C-1118-78

OCCURRENCE AND FATE OF ORGANIC AND INORGANIC CONTAMINANTS IN MARINE ANIMALS
Whittle, K.J., R. Hardy, A.V. Holden, R. Johnston, and R.J. Pentreath. 1977.
Annals of the New York Academy of Sciences Vol. 298:47-79. Proceedings.

Sources, Hydrocarbons, Uptake, Marine organisms, Contaminants

Present knowledge on the extent of contamination of marine animals, and the factors that affect it are summarized. A brief section on petroleum hydrocarbons reviews their inputs, the uptake mechanisms in various organisms, and the fate of various hydrocarbons within the organisms.

C-1119-78

THE AIR-WATER INTERFACE: PARTICULATE MATTER EXCHANGE ACROSS THE AIR-WATER INTERFACE
Winchester, J.W., and R.A. Duce. 1977.
Fate of Pollutants in the Air and Water Environments. Part 1. Mechanism of Interaction Between Environments and Mathematical Modeling and the Physical Fate of Pollutants. I.H. Suffet (ed.). New York, John Wiley & Sons, 1977. p. 27-47.

Dispersions, Sea surface, *Air-water interface, *Bursting bubbles

The transfer of several pollutants, including oil, from the ocean surface to the air by bursting of bubbles is reviewed. Particle transfer from air to water is also discussed. Included are 78 references.

4. MODELS AND PREDICTION

C-1120-78

MATHEMATICAL MODELING OF THE FATE OF PETROLEUM PARTICLES IN THE SEA [in Russian]
Akhmetov, A.Sh., V.I. Belyaev, and O.G. Mironov. 1977.
Vodnye Resursy No. 4:103-112.

Fate, Tar, Seawater, Models, *Petroleum particles

A generalized mathematical model of the fate of petroleum particles in the sea is described. The model incorporates biological, physical and chemical factors and considers the various states of these particles - as surface films, dispersions, solutions, or as large clumps on the sea floor.

[from Chemical Abstracts 88(4):#27554n. 1978]

C-1121-78

MODELING OF SELFPURIFICATION PROCESSES IN SEA WATER
Chernyshov, V.I., A.M. Bronfman, and Yu.S. Tokuev. 1976.
Ambio Special Report Vol. 4:179-186.

Oxidation, Petroleum products, Surfactants, Seawater, Models, *Phenols, *O_2 regimes

Models of pollutant oxidation by free radicals in physico-chemical processes are discussed. Oil, petroleum products and detergents are found to be potential sources of phenol pollution. Equations are derived which can predict an O_2 regime's response to marine pollution by petroleum and detergents.

[from Chemical Abstracts 88(4):#27624k. 1978]

C-1122-78

OILSIM (OIL SPILL SIMULATION MODEL) PHASE I

Krogh, F. 1977.

Det Norske Veritas Report No. 77-441. 75p.

Oil spills, Spreading, Behavior, Models, Ekofisk blowout, *OILSIM

The drift and spreading of oil spills is simulated using the "surface tension theory." The computer model uses realistic environmental data for wind and currents and incorporates parameters such as evaporation rates, temperature changes, and the specific weight and surface tension of the oil. Results may be presented on a line printer or on four-color screens. A brief discussion of the application of the OILSIM model to the Ekofisk Bravo blowout is included.

C-1123-78

A PREDICTIVE OIL SPILL SURFACE DRIFT MODEL FOR THE LABRADOR SEA

Noll, C.J. 1978.

Spill Technology Newsletter 3(2):22-31.

Models, Drift, Oil slicks, Labrador Sea, Offshore drilling

Computer modeling techniques have been applied to predict paths of spills originating from drilling locations in the Labrador Sea area. The model incorporates ice movement data with available weather and current data for a drilling season lasting from July to November. The northernmost site chosen was found to be the most critical with respect to coastline and fishing grounds contamination, particularly in July, when the predicted path of the slick comes within 80 km (50 mi) of the Labrador coastline.

C-1124-78

PHYSICAL OCEANOGRAPHY OF ESTUARIES (AND ASSOCIATED COASTAL WATERS)

Officer, C.B. 1976.

New York, John Wiley & Sons, 1976. xii + 465p.

Dispersions, Models, Estuaries, *Conservative and non-conservative pollutants

Chapter 6 of this book is entitled "Pollutant Dispersion." The theoretical calculations for determining dispersions for conservative and non-conservative pollutants are given and discussed. [possibly oil pollution related]

F. OIL POLLUTION REGULATIONS

1. LOCAL/STATE LEGISLATION

C-1125-78
COASTAL ZONE SUITS (news brief)
Anon. 1978.
Ocean Reporter (April-May):8.

State governments, API, Resource management, Coastal zone management

Three suits have been filed by API challenging the approval by the Office of Coastal Zone Management (OCZM) of coastal zone management plans in California, Massachusetts, and Wisconsin. API charges that the state plans do not meet the provisions set forth in the 1976 amendment to the Coastal Zone Management Act of 1972 which requires that the "national interest" in the siting of energy facilities be considered in the state programs before they can be approved by OCZM.

2. US LEGISLATION

C-1126-78
CARTER'S 1977 PROGRAM: WHERE IT STANDS TODAY
Anon. 1978.
Ocean Reporter (April-May):15-17.

Legislation, Regulations, Tankers, US, Pollution prevention, IMCO

Following the Argo Merchant oil spill in December 1976, President Carter established an Interagency Oil Pollution Task Force and announced its recommendations for prevention of further tanker disasters in a March 1977 message to Congress. Among the actions called for were US ratification of the 1973 IMCO Convention, introduction to Congress of oil spill liability and compensation legislation, and construction regulations that would include double bottoms, segregated ballast, inert gas systems, backup radar systems and improved emergency steering standards for tankers. The statuses of these and other proposed measures a year later are examined.

C-1127-78
PUBLICATION OF TOXIC POLLUTANT LIST
Anon. 1978.
Federal Register 43(21):4108-4109.

Legislation, Toxicity, Pollution control, *Federal Water Pollution Control Act

"A list of 65 toxic pollutants is published pursuant to the Federal Water Pollution Control Act." [possibly oil pollution related]

[from Chemical Abstracts 88(17):#116161z. 1978]

C-1128-78
COASTAL WATERS: A MANAGEMENT ANALYSIS
Armstrong, J.M., and P.C. Ryner. 1978.
Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc., 1978.
v + 240p.

Legislation, Regulations, Government agencies, State governments, Ports, Tankers, OCS, Coastal zone management

"Four major themes are presented: a description of various uses of coastal waters and the implications of those uses for comprehensive management; a description and analysis of existing bases of authority to manage coastal waters; a discussion of the Coastal Zone Management Act in terms of its utility for managing coastal waters; and a presentation of some concepts for coastal water management." Chapters 7, 8 and 10 cover deepwater ports, tanker safety, and OCS oil and gas development, respectively. The problems, regulatory systems and legislation associated with these concerns are discussed.

C-1129-78
THE WATER POLLUTION CONTROL ACT (AS AMENDED IN 1972, P.L. 92-500)
Bregman, J.I., and G. Beeland. 1976.
Handbook of Water Resources and Pollution Control. H.W. Gehm, J.I. Bregman, and G.V. Beeland (eds.). New York, N.Y., Van Nostrand Reinhold Co., 1976. p. 780-802.

Legislation, US, Oil discharge, Oil spills, Liability, *Water Pollution Control Act

The title Act, with its 1972 amendments, is reviewed in detail from the perspective of its significance to engineers in the pollution control field. Section 311 of this Act establishes national policy in regards to oil and hazardous substance discharge liability.

C-1130-78
WHAT THE NEW CLEAN WATER ACT MEANS TO HPI PLANT MANAGERS
Harrison, E.B. 1978.
Hydrocarbon Processing 57(2):165,167,170,172.

Legislation, US, Pollution control, Liability, *Clean Water Act 1977

The changes brought about by the amendment of Public Law 92-500, known as the Clean Water Act of 1977, and their effects on industry, are discussed. Included is an explanation of oil spill liability.

C-1131-78
HOW WATER REGS IMPACT REFINING
Heath, D.P. 1978.
Hydrocarbon Processing 57(5):135-138.

Legislation, EPA, Refineries, Wastewater treatment, *Clean Water Act 1977

Implications of the Clean Water Act of 1977 for the oil refining industry are discussed.

C-1132-78
ENVIRONMENTAL ASSESSMENT PROGRAMME (letter to the editor)
Shaw, D.G. 1978.
Marine Pollution Bulletin 9(5):140.

Legislation, NOAA, *Research management

The Ocean Pollution Research Program Act was recently passed by the US legislature. Managed under NOAA, the program was established for the comprehensive planning of federal marine pollution research.

C-1133-78
STRIKING A BALANCE: ENVIRONMENTAL AND NATURAL RESOURCES POLICY IN THE NIXON - FORD YEARS
Whitaker, J.C. 1976.
Washington, D.C., American Enterprise Institute for Public Policy Research, 1976. xv + 344p.

OCS, Environmental protection, Legislation, Liability, Deepwater ports, Santa Barbara Channel

Chapter 11 of this book, entitled "Offshore Oil, Superports, and the Environment," traces the development of the OCS leasing program and the evolution of government policies concerning oil pollution as triggered by the 1969 Santa Barbara blowout. Included are discussions on environmental assessment monitoring, oil spill liability, and superports.

3. INTERNATIONAL LEGISLATION

C-1134-78
SHIFT AT GENEVA (news brief)
Anon. 1978.
Ocean Reporter (April-May):8.

International agreements, Law enforcement, Tankers, US, *Law of the Sea

At the recent Law of the Sea meeting held in Geneva, the US delegation, in the aftermath of the Amoco Cadiz spill, called for "recognition of the right of coastal nations to take action against violations of international pollution codes in their 200-mile fishing and resource zones." This new proposal is discussed in relation to presently existing jurisdictional codes.

C-1135-78
SOME REFLECTIONS ON IMCO...REAL PROGRESS OR FALSE HOPES?
Anon. 1978.
Ocean Reporter (April-May):18-19.

Tankers, IMCO, International conventions, Segregated ballast, Pollution prevention

The provisions of the 1973 IMCO Convention are examined with respect to their effectiveness in achieving IMCO's goal of "completely eliminating willful and intentional pollution of the seas by the end of the present decade."

C-1136-78
LAW OF THE SEA IN OUR TIME - I. NEW DEVELOPMENTS 1966-1975
Oda, S. 1977.
Leyden, Netherlands, Sijthoff International Publishing Co., 1977.
269p.

International agreements, International conventions, Pollution prevention, Legislation, Regulations, *Law of the Sea

Chapter 5 of this book examines recent international policy developments in regard to marine pollution. Briefly reviewed are international efforts to prevent marine pollution since the 1950's, and the most prevalent types of marine pollutants, including petroleum products. National and international legal mechanisms to prevent marine pollution, and jurisdiction of coastal nations in controlling pollution are discussed.

4. FOREIGN LEGISLATION

C-1137-78
ROUND-THE-WORLD NEWS: ISRAEL (news brief)
Dixon, T., and T.R. Dixon. 1978.
Marine Pollution Bulletin 9(6):148.

Resource management, Pollution prevention, Israel, Mediterranean Sea, Coasts

Israel announced a comprehensive plan to protect its coastal resources and to contribute towards the improvement of the environmental quality of the Mediterranean Sea. Emphasis was placed on the prevention of oil pollution, including plans for new de-ballasting and bilge water reception facilities, and strengthened legal measures.

C-1138-78
LEGAL CONTROL OF POLLUTION FROM NORTH SEA PETROLEUM DEVELOPMENT
Fitzmaurice, V. 1978.
Marine Pollution Bulletin 9(6):153-156.

Pollution control, Offshore development, Legislation, North Sea, Norway, UK

The current Norwegian and UK laws pertinent to pollution control from North Sea petroleum development are outlined. Emerging law aimed at reducing the pollution probability via equipment failure or human error is discussed. Suggestions are given to improve legal protection.

5. STANDARDS AND GUIDELINES

C-1139-78
COASTAL OIL SPILL IMPACT ASSESSED (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(4):87-88.

Oil spills, Onshore impacts, Coasts, Guidelines, *Shoreline type classification, *Case studies

The University of South Carolina Oil Spill Assessment Team recently published results of an investigation of major spills throughout the world, including the *Metula*, the *Jakob Maersk*, and the *Urquiola* spills. The case studies illustrate the highly variable oil spill impact on coastal zones. The USC group developed a system of classifying shoreline types according to potential vulnerability to spill damage for use in conjunction with a viable oil-spill contingency plan.

C-1140-78
PUBLISHED REGULATORY GUIDELINES OF ENVIRONMENTAL CONCERN TO THE OIL INDUSTRY IN WESTERN EUROPE (news brief)
Anon. 1978.
Water, Air, and Soil Pollution 9(2):249-250.

Oil industry, Regulations, Pollution prevention, Europe

The 6th updated version of CONCAWE's report 2/77 (July 1977) on environmental regulations for the oil industry in Western Europe has been issued. The report may be obtained from CONCAWE, 60 Van Hogenhoucklaan, Den Haag, 2018, The Netherlands.

C-1141-78
AMOCO CADIZ INCIDENT POINTS UP THE ELUSIVE GOAL OF TANKER SAFETY
Carter, L.J. 1978.
Science 200(4341):514-516.

Safety, Tankers, Oil spills, Environmental protection, Amoco Cadiz spill, *Negotiations

The wreck of the Amoco Cadiz represents the massive environmental problem associated with tanker safety and oil spills. Groundings and collisions account for a portion of the pollution problems; structural failures and chronic pollution from cleaning and ballasting operations account for a greater proportion of oil outflow. The author provides an overview of the recent political interchange between US government negotiators and IMCO members. Issues under scrutiny include tanker construction and operating standards, oil spill liability laws, prescribed tanker routes and marine sanctuaries, and stiffer inspections.

C-1142-78
COASTAL ECOSYSTEM MANAGEMENT: A TECHNICAL MANUAL FOR THE CONSERVATION OF COASTAL ZONE RESOURCES
Clark, J.R. 1977.
New York, John Wiley & Sons, 1977. x + 928p.

Coastal zone management, Guidelines, Manuals, Industries, Conservation

This book presents an overview of the general uses of coastal and estuarine areas in various types of industry and sets forth standards and guidelines for ecologically effective management of coastal projects. Each of 24 different industrial uses of the coastal zone are discussed separately in Chapter 6, with one section devoted to the oil and gas industries. "The appendices present a variety of tabular, graphic, and textual matter to assist planners and managers in technical aspects of their programs."

C-1143-78
ENERGY, PUBLIC CHOICES AND ENVIRONMENTAL DATA NEEDS
Graves, F.M., H.P. Bretsch, F.A. Glover, C.A. Miller, and M.E. Berger. 1977.
Report FWS/OBS-77/04, Contract DI-14-16-0008-2103. 126p.

Government agencies, Oil industry, Environmental protection, Wildlife, Fish, Oil shale, Resource management

Energy-related decision processes of the BLM, USGS, Forest Service, Bureau of Reclamation, ERDA, Water Resources Council, and the states of Montana, New Mexico, Utah, Colorado, and Wyoming are discussed. Recommendations are made for more effective communication of wildlife information by the Fish and Wildlife Service to "decision makers."

[from Government Reports Announcements 77(25):#PB-272 263/5GA. 1977]

6. AGREEMENTS AND CONVENTIONS

C-1144-78
AMOCO CADIZ COMPENSATION (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(6):148.

Amoco Cadiz spill, Compensation, Spill cleanup, *CRISTAL

The Oil Companies Institute for Marine Pollution Compensation Ltd. revealed that $30 million is available for cleanup operations and compensation payments of the *Amoco Cadiz*. The Institute administers a voluntary oil industry plan called CRISTAL.

C-1145-78
IMCO POLLUTION MOVES (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(3):62.

IMCO, Tankers, Segregated ballast, Crude oil washing, Pollution prevention

Segregated ballast tanks (SBT) and crude oil washing (COW) were the main discussion topics at the conference of the Inter-Governmental Maritime Consultative Organization (IMCO) on tanker safety and marine pollution prevention. A controversial US proposal called for the redesign and fitting of all tankers over 20,000 tons with SBT, a system using separate tanks for oil and water. The British government favored the COW system for reasons of economy.

C-1146-78
TANKER POLLUTION - WHAT NOW?
Anon. 1978.
Ocean Reporter (April-May):3-7.

Tankers, IMCO, International agreements, Segregated ballast, Crude oil washing, Safety, *Amoco Cadiz* spill

In the wake of the *Amoco Cadiz* disaster, which occurred in March 1978 off the coast of Brittany, concern for standards of tanker safety has become more acute. This article examines the recent IMCO agreement, hailed as producing the toughest standards to date, in light of the *Amoco Cadiz* spill. The agreement is discussed with respect to President Carter's 1977 recommendations for more stringent pollution control measures, which called for the installation of double bottoms in new tankers and segregated ballast systems in existing tankers. Both of these measures were rejected at the IMCO meeting, and the standards adopted instead are outlined.

C-1147-78
TECHNICAL AND ECONOMIC CONSEQUENCES OF ENVIRONMENTAL PROTECTION MEASURES ON SEAGOING SHIPS. I [in German]
Block, P. 1977.
Seewirtschaft 9(3):136-138.

Guidelines, Economics, Pollution prevention, International conventions, Ships

"An outline of the provisions of the 1973 and 1974 conventions on the prevention of maritime pollution by ships, and specific measures to limit pollution of oils and lubricants, waste water and refuse are described."

[from Environmental Health and Pollution Control 13(1):#151. 1978]

C-1148-78
TECHNICAL AND ECONOMIC CONSEQUENCES OF ENVIRONMENT PROTECTION MEASURES ON SEAGOING SHIPS. II [in German]
Block, P. 1977.
Seewirtschaft 9(4):197-201.

Guidelines, IMCO, Economics, Tankers, Pollution prevention, Design-engineering

"The author reviews design and economic consequences of the guidelines set down for tankers during the 1973 IMCO convention. The special constuctional and installation requirements following from these guidelines are reviewed. Design and installations required to meet criteria for obtaining the International Oil Pollution Prevention Certificate (1973) are given."

[from Environmental Health and Pollution Control 13(1):#152. 1978]

C-1149-78
THE MIXED BLESSING OF THE LATEST MARINE POLLUTION PACKAGE (editorial)
Sebek, V. 1978.
Marine Pollution Bulletin 9(4):85-87.

IMCO, Tankers, International conventions, Segregated ballast, Crude oil washing, Pollution prevention

The measures adopted by IMCO at the February 1978 International Conference on Tanker Safety and Pollution Prevention are discussed. The two Protocols accepted include provisions for design and equipment of tankers and stricter procedures for inspection and certification. The conference was dominated by the controversy between supporters of two different, but complementary, methods of reducing ship-generated pollution: segregated ballast tanks (SBT) and crude oil washing system (COW).

C-1150-78
TREATIES AND OTHER INTERNATIONAL AGREEMENTS ON FISHERIES, OCEANOGRAPHIC RESOURCES, AND WILDLIFE INVOLVING THE UNITED STATES
US Congress. Senate. Committee on Commerce, Science, and Transportation. 1977.
Washington, D.C., Government Printing Office, 1977. 1201p.
(Committee Print, 95th Congress, 1st Session)

International conventions, International agreements, US, Pollution prevention, Liability, Compensation, Contingency planning

This compilation is a revision of the 1974 publication and includes international conventions since 1954 concerning prevention, intervention, liability, and compensation in oil pollution cases, a 1976 Bermudan bilateral agreement on oil pollution, and a 1974 Canadian bilateral agreement for establishment of joint pollution contingency plans.

G. BIBLIOGRAPHIES

C-1151-78
MORE OIL BIBLIOGRAPHIES (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(5):117

Bibliographies, Dispersants, Fate, Environmental effects, Canada

Two new bibliographies relating to oil pollution are available through the Environmental Protection Service (5151 George Street, Halifax, N.S., Canada). The first is A Selected Bibliography on the Fate and Effects of Oil Pollution Relevant to the Canadian Marine Environment (EPS-3-EC-77-23) and contains 598 titles and a "Keyword in context " index. The second is A Selected Bibliography on Oil Spill Disperants (EPS-3-EC-78-2) and has 402 titles, and author and keyword indexes.

C-1152-78
OIL BIBLIOGRAPHY (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(4):91.

Bibliographies, Oceans, Estuaries

The Marine Pollution Information Center at Plymouth, UK, recently published a second supplement to the 1971 edition, "Bibliography on Marine and Estuarine Oil Pollution." The supplement contains 1100+ references, and excludes legal, economic, and social aspects, as well as papers on seabirds. It is obtainable at a cost of $15 from the Marine Pollution Information Center, Marine Biological Association of the United Kingdom, Citadel Hall, Plymouth, UK.

C-1153-78
WATER POLLUTION IN ESTUARIES AND COASTAL ZONES. VOLUME 2. 1975 - SEPTEMBER 1977 (A BIBLIOGRAPHY WITH ABSTRACTS)
Brown, R.J. 1977.
Report NTIS/PS-77/0840/7GA. 220p. Report 1964-Sep 77. (Supersedes NTIS/PS-76/0852, NTIS/75/698, and NTIS/PS-74/100)

Bibliographies, Estuaries, Coasts, Pollution control, Environmental effects, Development

Research reports of studies concerning water pollution from estuarine and coastal development, its effects and control are abstracted. The reports are not restricted to any one coastal area. Pollution is related to the following topics: urbanization, government actions, coastal zone planning, natural resource development, and sewage and solid waste disposal. The bibliography contains 215 abstracts, 70 of which are new entries.

[from Government Reports Announcements 77(25):#NTIS/PS-77/0840/7GA. 1977]

C-1154-78

SUPERTANKERS AND SUPERPORTS (CITATIONS FROM THE NTIS DATA BASE)
Habercom, G.E., Jr. 1977.
Report NTIS/PS-77/0700. 123p. Report for 1964 - July 1977.
(Supersedes NTIS/PS-76/0591, NTIS/PS-75/510, and NTIS/PS-74/088)

Bibliographies, Tankers, Ports, Environmental effects, Oil spills, *Supertankers, Deepwater ports

This updated bibliography contains 118 abstracts, 21 of which are new entries, covering construction and operation of supertankers, requirements for port facilities, and environmental aspects. [Relevant papers are abstracted separately in this issue of OPR.]

C-1155-78

SUPERTANKERS AND SUPERPORTS (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Habercom, G.E., Jr. 1977.
Report NTIS/PS-77/0701. 113p. Report for 1970 - July 1977.
(Supersedes NTIS/PS-76/0592)

Bibliographies, Tankers, Ports, Environmental effects, *Supertankers, Deepwater ports

This updated bibliography contains 106 abstracts, 31 of which are new entries, covering construction and operation of supertankers and requirements for port facilities. Environmental aspects, offshore mooring sites, and harbor preparation are among the topics investigated. [Relevant papers are abstracted separately in this issue of OPR.]

C-1156-78

ENVIRONMENTAL TOXICOLOGY. A GUIDE TO INFORMATION SOURCES
Rudd, R.L. 1977.
Detroit, Michigan, Gale Research Co., 1977. xii + 266p.
(Man and the Environment Information Guide Series, Vol. 7)

Bibliographies, Toxicity, *Information sources, Environmental effects

An annotated bibliography of government documents, periodical literature, scientific journals, and other reference materials relevant to environmental toxicology is presented. Included are several pre-1975 background references on the fate and biological effects of oil pollution in the marine environment.

H. MISCELLANEOUS

C-1157-78
ACCREDITATION OF TESTING LABORATORIES FOR SAFETY AND POLLUTION PREVENTION EQUIPMENT USED ON OFFSHORE OIL AND GAS OPERATIONS
[American Society of Mechanical Engineers]. 1977.
New York, N.Y., American Society of Engineers, 1977. 18p.
(Publication ANSI/ASME OCS-2-1977)

Safety, Equipment, Pollution prevention, Offshore production, *Accreditation, *Testing Laboratories

"Provides requirements for the accreditation of testing laboratories which provide testing of safety and pollution prevention equipment used in offshore oil and gas operations. Includes: responsibilities and duties; quality assurance program; laboratory requirements; certificates of accreditation; and specific test requirements, results and sample application forms. Price includes an automatic subscription to the addenda issued up to 1981." Available from ASME Order Dept., 345 E.47th St., New York, N.Y. 10017.

[from New Books from ASME-1978. Book No. A00094. 1978]

C-1158-78
QUALITY ASSURANCE AND CERTIFICATION FOR SAFETY AND POLLUTION PREVENTION EQUIPMENT USED IN OFFSHORE OIL AND GAS OPERATIONS
[American Society of Mechanical Engineers]. 1977.
New York, N.Y., American Society of Engineers, 1977. 28p.
(Publication ANSI/ASME OCS-1-1977)

Safety, Equipment, Pollution prevention, Offshore production, *Quality assurance, *Certification

"Includes requirements for: quality assurance programs; attendant certification of manufacturers and assemblers; and equipment failure reporting of Operators of Offshore Safety and Pollution Prevention Equipment (SPPE)...price includes an automatic subscription to the addenda issued up to 1981." Available from ASME Order Dept., 345 E. 47th St., New York, N.Y. 10017.

[from New Books from ASME-1978. Book No. A00093. 1978]

C-1159-78
POLLUTION, SAFETY, AND DISASTER PREVENTION [English summary]
Ando, H., H. Ohuchi, N. Kido, K. Shiota, et al. 1975.
Sekiyu Gakkai Shi 18(6):513-527.

Pollution control, Wastewater treatment, Solid wastes, Oceans, Safety, *Review

"A review with 1046 references of air pollution and control methods, water pollution and wastewater treatment, solid waste treatment, ocean pollution, safety, and fire prevention, etc." [possibly oil pollution related]

[from Chemical Abstracts 88(10):#65209m. 1978]

C-1160-78
VIEWPOINT: TELEMEDIATORS IN THE MARINE ENVIRONMENT
Aubert, M., J. Aubert, and M. Gauthier. 1978.
Marine Pollution Bulletin 9(4):93-95.

Bioindicators, Sublethal effects, Contamination, *Telemediators

The article addresses chemical telemediators defined as "...substances synthesized by marine animals or plants which are released into the environment and act remotely upon the behavior or the biological functions of the same or of other species." Test results indicate that hydrocarbons and other marine pollutants may have an antagonistic or synergistic action toward telemediators at concentrations 1000-10,000 times lower than the toxicity threshold. "It can thus be seen how sensitive the marine medium is to attacks from exogenous contamination and how useful it is to know the mechanisms that contribute to keeping it at its normal level."

C-1161-78
REFLECTIONS ON UNDERGROUND WATER POLLUTION BY HYDROCARBONS [in French]
Bossy, G. 1975.
Colloque sur la Pollution et la Protection des Eaux de la Region Rhone-Alpes, [Comptes-Rendus], 2nd, Lyon, D 5-7, 1972. E. Pattee (ed.). Lyon, Institute Pasteur Lyon, 1975. Vol 2:547-570.

Hydrocarbons, Contamination, Water quality, Groundwater, *Review

"A review with 16 references."

[from Chemical Abstracts 88(22):#158053w. 1978]

C-1162-78
IMPORTANCE OF THE ACTIVITY OF A FACTORY TOXICOLOGICAL LABORATORY IN DEALING WITH THE PROBLEMS OF THE WORKING ENVIRONMENT [English summary]
Brambor, J., and A. Lazova. 1977.
Ceskoslovenska Hygiena 22(8):338-340.

Statistics, Toxicity, Gasoline, Petroleum products, Industries, *Toxicological laboratory

The environmental impacts of gasoline and oil are included in this statistical report on the work of the in-plant toxicological laboratory of a chemical plant.

[from Chemical Abstracts 88(10):#65435g. 1978]

C-1163-78
ANTHROPOGENIC AND NATURAL TYPE POLLUTION [in Italian]
Ciusa, W. 1976.
Atti della Accademia delle Scienze dell'Istituto di Bologna,
Classe di Scienze Fisiche, Rendiconti 3(1):11-27.

Contaminants, Fuels, Environmental deterioration

"The character of pollution of the earth's environment as a result of natural and human forces, particularly the recovery and use of fossil fuels and metals, is reviewed with 26 references." [possibly oil pollution related]

[from Chemical Abstracts 88(6):#40919e. 1978]

C-1164-78
NEWS AND COMMENT: "SEABIRD GROUP REPORT 1976-77"(news brief)
Conder, P., and M. Everett. 1978.
British Birds 71(3):142-143.

Birds, Platforms, *Field observations

A brief outline of the Seabird Group's latest report is given. Included is a request for its members to organize more voyages on research ships and observations from oil platforms and production installations.

C-1165-78
THE MUSSEL MYTILUS EDULIS AS A BIO-ASSAY ORGANISM FOR MERCURY IN SEAWATER
Davies, I.M., and J.M. Pirie. 1978.
Marine Pollution Bulletin 9(5):128-132.

Bioassay, Bioindicators, Mollusks, Uptake, *Mercury, *Field technique

A field bioassay technique is described using the title organism in detecting mercury concentrations in seawater. The technique is adaptable for use with other organisms and pollutants. [possibly oil pollution related]

C-1166-78
MARINE RESOURCES POTENTIAL (book review)
Denness, B. 1978.
Marine Pollution Bulletin 9(3):83-84.

Biological effects, Book review, *Proceedings

A review is given of Technology Assessment and the Oceans, edited by P.D. Wilmot and A. Slingerland (International Conference on Technology Assessment, Monaco, 26-30 October 1975; publication is available in US from Westview Press, Inc., 1898 Flatiron Court, Boulder, CO 80301). Three papers comprise the section on pollution. In one of these papers, Marsden and Taylor draw attention to the problems of assessing the biological effects of oil pollution.

C-1167-78
THE CANADIAN WEST COAST OIL PORTS ENQUIRY (news brief)
Ellis, D. 1978.
Marine Pollution Bulletin 9(5):115.

Environmental effects, Oil terminals, Pipelines, Canada

Dr. Andrew Thompson was appointed commissioner of the title enquiry. The expanded enquiry is investigating the environmental consequences of three proposed oil terminal/pipeline alternatives. The terminal would accept primarily Alaskan oil from supertankers and transport the oil by pipeline to the mid-west US.

C-1168-78
POLLUTION CONTROL DIRECTORY (book review)
Jenkins, S.H. 1978.
Marine Pollution Bulletin 9(4):112.

Pollution control, Equipment, Europe, Industry, *Directory

This reference book provides good coverage of companies concerned with oil pollution and their products or consultancy services. Information is included about companies in 17 countries in Western Europe. A subject index and a more informative equipment and manufacturer index is also provided. The Directory of Pollution Control Equipment Companies in Western Europe, R. Whiteside (ed.), is available from Graham & Trotman, London (1977, 614p.).

C-1169-78
TOXIC EFFECTS OF POLLUTION ON PISCICULTURAL FAUNA [in French]
Leynaud, G. 1976.
Pollution des Eaux Continentales: Incidences sur les Biocenoses Aquatiques. P. Pesson (ed.). Paris, France, Gauthier-Villars, 1976. p. 135-148.

Fish, Toxicity, Contaminants, Behavior, Analytical techniques

"A review [is presented] with 12 references of the physiological elements of fish involved in toxicological responses, of fish behavior in toxic media, and of the techniques used in studying the toxicity of pollutants to fish." [possibly oil pollution related]

[from Chemical Abstracts 87(21):#162277u. 1977]

C-1170-78

A FLUME FOR THE STUDY OF CONTAINED OIL SLICKS
Milgram, J., and R. Van Houten. 1977.
Report of the Massachusetts Institute of Technology Sea Grant Program No. 77-19, Sea Grant 04-6-158-44007. 45p.

Behavior, Oil slicks, Spill containment, *Flume

"A basic design that is a 'hybrid' of the sump type of flume and the 'wind tunnel circuit' type of flume is described and the overall geometry is shown."

[from Aquatic Sciences and Fisheries Abstracts Part 1 8(1):#694-1Q8. 1978]

C-1171-78

A TECHNIQUE FOR STUDYING AND MAPPING THE ENVIRONMENTAL IMPACT OF INDUSTRIAL PRODUCTION (WITH PARTICULAR REFERENCE TO THE SOVIET FAR EAST)
Nefedova, T.G., and I.R. Spektor. 1976.
Soviet Geography 17(9):604-612.

Environmental effects, Industries, Production, Petroleum products, *Impact maps

"An attempt is made to design a map that would reflect the impact of human activity on the environment and form a connecting link between socio-economic maps and physical maps." Water pollution by petroleum products is considered.

C-1172-78

EVALUATION OF A CELL CULTURE ASSAY FOR DETERMINATION OF WATER QUALITY OF OIL-REFINERY EFFLUENTS
Richardson, D., T.C. Dorris, S. Burks, R.H. Browne, et al. 1977.
Bulletin of Environmental Contamination and Toxicology 18(6):683-690.

Bioassay, Toxicity, Water quality, Refineries, Wastewaters, *Daphnia

"A comparison was made between Daphnia and cell culture bioassays of the toxicity of a reference compound, m-cresol, and then these procedures were applied to complex fractions derived from oil-refinery effluents. The cell culture assay was established as a sensitive, reliable, and reproducible method for determining the toxicity of oil refinery effluents."

[from Chemical Abstracts 88(18):#125949q. 1978]

C-1173-78
EVALUATION OF THE LOSS OF NONSOLVENTS DURING THE LEACHING OF SALT DEPOSITS [in Russian]
Ruchnova, A.G. 1975.
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo i Proektnogo Instituta Galurgii Vol. 76:26-36.

Petroleum products, Groundwater, *Leaching, *Salt deposits

"Liquid petroleum and petroleum products are used as nonsolvents to control the leaching of underground rock-salt deposits with water.... The loss of petroleum is caused by formation of stable water-petroleum emulsions, chemical and biochemical oxidation of the petroleum, increasing petroleum density, and adsorption of asphalt and tar components in the leaching chamber."

[from Chemical Abstracts 88(10):#63731b. 1978]

C-1174-78
AMOP EXPERIMENTAL OILSPILL PLANNING
Thornton, D.E. 1978.
Spill Technology Newsletter 3(3):8-9.

Pollution prevention, Pollution control, Biological effects, Arctic, *Research proposals, *AMOP

This article announces a series of research projects that are to be conducted as part of the Arctic Marine Oilspill Program (AMOP), and solicits project proposals for three main categories of interest: 1.) oil spill countermeasures, 2.) oil spill behavior and fate, and 3.) biological effects of oil spills. Project suggestions should be forwarded to Dr. D.E. Thornton, Research and Development Division, EPS, Environment Canada, 9942-108 St., Edmonton, Alberta T5K 2J5, Canada.

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information, and a summary of project objectives are provided in each entry. Project notices have been obtained from: the Smithsonian Science Information Exchange (SSIE); API Environmental Research Annual Status Report; Maritime Research Information Service Abstracts; Scientific and Technical Aerospace Reports; Department of Environment, Canada, Spill Technology Newsletter; Northwest and Alaska Fisheries Center Monthly Report; and written inquiries to organizations and researchers. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered sequentially with a citation number R-   -78. Some of the projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted with a current serial number, followed by the original number in parentheses. To locate the original entry, refer to the following list:

Citation Numbers		Dates Covered	Report Number
R-001-74 to R-165-74		July 74 - Oct. 74	EPA-670/2-75-003
R-166-74 to R-244-74		Nov. 74 - Feb. 75	EPA-670/2-75-044
R-245-74 to R-268-74		Feb. 75 - Apr. 75	EPA-670/2-75-059
R-269-74 to R-342-74		May 75 - July 75	EPA-600/2-76-129
R-269-75 to R-304-75		Aug. 75 - Oct. 75	EPA-600/2-76-113
R-001-76 to R-035-76		Nov. 75 - Jan. 76	EPA-600/2-76-185
R-036-76 to R-063-76		Feb. 76 - Apr. 76	EPA-600/2-76-215
R-064-76 to R-123-76		May 76 - July 76	EPA-600/2-76-266
R-124-76 to R-175-76		Aug. 76 - Oct. 76	EPA-600/2-77-037
R-001-77 to R-022-77		Nov. 76 - Jan. 77	EPA-600/2-77-075
R-023-77 to R-039-77		Feb. 77 - Apr. 77	EPA-600/2-77-111
R-040-77 to R-075-77		May 77 - July 77	EPA-600/2-77-243
R-076-77 to R-096-77		Aug. 77 - Oct. 77	EPA-600/2-78-005
R-001-78 to R-020-78	5(1)	Nov. 77 - Jan. 78	EPA-600/2-78-071
R-021-78 to R-057-78	5(2)	Feb. 78 - May 78	Submitted 6/78

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

[No entries.]

2. MONITORING

R-058-78
THE EFFECT OF RECREATION ON WATER QUALITY
Principal Investigator: Byrd, J.E., and M.J. Perona
Performing Organization: California State University and Colleges, Graduate School, 800 Monte Vista Ave., Turlock, CA 95380
Supporting Agency: US Dept. of the Interior, Office of Water Research & Technology, 19th & C Sts. NW, Washington, D.C. 20240. No. A-064-CAL
Period: 10/77 - 9/78

Monitoring, Gasoline, Water quality, GC/MS, Lakes, *Recreational boating, California

"The effect of recreational boating on the water quality of a reservoir will be studied. Emphasis will be placed on monitoring lead and gasoline residues, and on determining the sources and sinks of lead in the aquatic environment." Turlock Lake in Stanislaus County, California will be studied. GC/MS will be used for the gasoline analysis.

[SSIE No. GUY-1035]

R-059-78
DYNAMICS OF THE INCLINING SPAR CURRENT SENSOR
Principal Investigator: Mavor, J.W.
Performing Organization: Woods Hole Oceanographic Institute, Main St., Woods Hole, MA 02543
Supporting Agency: US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235
Period: 10/76 - 9/77
Funds: $35,000

Monitoring, Oil spills, Dispersions, Oceans, *Current sensor, *Inclining spar buoy

Project objectives are to "decrease the cost and increase the usefulness of ocean current measurements with practical applications... [and to]...understand better the dynamics of the moored inclining spar buoy used as a current sensor so that its response to waves can be a useful measurement." Application of this information will include oil pollution dispersion measurements.

[SSIE No. GBP-2939]

3. REMOTE SENSING

[No entries.]

4. SAMPLING

R-060-78
LEACHABILITY OF PETROLEUM INDUSTRY SOLID WASTES

Principal Investigator:	Unknown
Performing Organization:	Systems Technology Corporation
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 803-76
Period:	Unknown

Sampling, Solid wastes, Oil industry, Groundwater, Contamination, *Leaching test

A practical procedure for assessing the leachability characteristics of petroleum industry solid wastes is being developed under this contract.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Reports and Publications

DEVELOPMENT OF A LEACHING TEST FOR PETROLEUM WASTES
Systems Technology Corporation. 1978.
Final report.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-061-78 (R-068-76)

DEVELOPMENT OF AN X-RAY RADIOGRAPHIC BENTHIC (BOTTOM) BASELINE METHOD

Principal Investigator: Howard, J.D.
Performing Organization: Skidaway Institute of Oceanography, Savannah, GA 31406
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 211-75
Period: Unknown

Sampling, Analytical techniques, Benthos, Biological effects, Oil spills, Buzzards Bay, *X-ray radiography

X-ray radiography was used to determine the effects of an oil spill on offshore benthos in soft sediment. Field work was performed during mid-1975 at the general site of the 1969 oil spill at Buzzards Bay, Massachusetts. Sampling and examination was conducted for 208 geologic and zoologic samples from 104 stations in the spill area and control sites.

Status: A draft final report was submitted in March 1976, indicating no significant difference in bottom life between the contaminated and control sites.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

5. ANALYSIS

R-062-78

PROPERTIES OF TYPICAL REFINERY SOLID WASTES

Principal Investigator: Unknown
Performing Organization: Unknown
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington D.C. 20037. No. 801-78
Period: Unknown

Solid wastes, Refineries, Toxicity, Sludge, EPA, API, *Tank cleaning, Water quality

Refinery solid wastes will be analyzed for levels of hazardous components or properties and assessed according to evolving EPA criteria being considered under the Resource Conservation and Recovery Act. Selected typical wastes will include biosludge, crude tank cleaning, tank cleaning, API separator sludge, and spent filter clay. The contractor has not yet been determined.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-063-78

ANALYSIS OF BPCTCA REFINERY EFFLUENT - PHASE II

Principal Investigator: Unknown

Performing Organization: Exxon Research & Engineering

Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St., NW, Washington, D.C. 20037. No. 507-77

Period: Unknown

Wastewaters, Refineries, Sampling, Activated sludge, *Residuals, *PNA

Sampling and analyses have been conducted to determine the types and amounts of residuals (principally volatile organohalides and polynuclear aromatics -- PNAs) in a second BPCTCA refinery effluent and a second municipal sewage treatment plant. The removal of these materials across various pilot plant wastewater treatment trains is also determined. Results indicate low values of residuals in the effluents from the refinery activated sludge units.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Status: The contract was amended in February 1978 to include work covering the identification and measurement of high molecular weight compounds contributing to total organic carbon (TOC) in a BPCTCA refinery effluent and intake waters.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-064-78

EVALUATION OF ANALYTICAL SYSTEMS AND ANALYSIS OF PETROLEUM INDUSTRY EFFLUENTS

Principal Investigator: Unknown

Performing Organization: Radian Corporation, and Exxon Research and Engineering

Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 508-78

Period: ? - 12/78

Wastewaters, Refineries, Contaminants, Toxicity, Analytical techniques, Sampling

Project objectives are "to review, evaluate, and critique analytical methods and protocols selected by regulatory agencies for qualitative and quantitative assessments concerning the presence or absence of trace toxic pollutants in refinery wastewaters." Refinery sampling and analysis programs are also being conducted.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Reports and Publications

ANALYSIS OF REFINERY WASTEWATERS FOR THE EPA PRIORITY POLLUTANTS
American Petroleum Institute. 1978.
API Publication No. 4296. Interim report.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-065-78 (R-056-76)
BIOASSAYS OF REFINERY EFFLUENT

Principal Investigator:	Buikema, A.L.
Performing Organization:	Virginia Polytechnic Institute and State University, School of Arts & Sciences, Burruss Hall, Blacksburg, VA 24061
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 501-77
Period:	Unknown

Bioassay, Toxicity, Refineries, Wastewaters, Freshwater, Intertidal zone, Invertebrates, Fish, Analytical techniques

Simple test procedures are being developed for evaluating the toxicity of refinery effluents to fresh and saltwater microinvertebrates. In the freshwater bioassays Daphnia pulex methodology was used, and relationships between Daphnia tests and fish tests were determined. Tests of tidewater invertebrates and fish were also compared in the saltwater phase. The 1977 research focussed on correlating bioassay sensitivities between grass shrimp and selected estuarine fish.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-066-78
ENERGY RELATED WATER POLLUTANT ANALYSES INSTRUMENTATION

Principal Investigator:	Hertz, H.
Performing Organization:	US Dept. of Commerce, Analytical Chemistry Division, 14th St. Bet. Const. Ave. NW, Washington, D.C. 20234
Supporting Agency:	US Environmental Protection Agency, Office of Energy, Minerals & Industry, 401 M St. SW, Washington, D.C. 20460. Interagency No. D7-E684, V625D-60
Period:	10/76 - 9/77
Funds:	$110,000

Chemical analysis, Crude oil, Solubility, Spectrometry, *Marker compounds, *SRM

The purpose of this project is to release a series of SRM's for trace petroleum in water analyses.

Status: The solubility of petroleum in water was assessed in order to evaluate the feasibility of a crude oil in water SRM. A preliminary stability study of petroleum marker compounds in water was also conducted.

[SSIE No. GMA-4658]

Reports and Publications

DETERMINATION OF TRACE LEVEL HYDROCARBONS IN MARINE BIOTA
Chesler, S.N., B.H. Gump, H.S. Hertz, W.E. May, and S.A. Wise. 1978.
Analytical Chemistry 50(6):805-810.

INTERLABORATORY COMPARISON OF DETERMINATIONS OF TRACE LEVEL PETROLEUM HYDROCARBONS IN MARINE SEDIMENTS
Hilpert, L.R., W.E. May, S.A. Wise, S.N. Chesler, and H.S. Hertz. 1978.
Analytical Chemistry 50(3):458-463.

AN ANALYSIS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT: RESULTS OF AN INTERLABORATORY COMPARISON EXERCISE
May, W.E., S.N. Chesler, B.H. Gump, and H.S. Hertz. 1978.
Journal of Environmental Science and Health A13(5&6):403-410.

METHODS FOR POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS IN THE MARINE ENVIRONMENT
Wise, S.A., S.N. Chesler, H.S. Hertz, L.R. Hilpert, and W.E. May. 1978.
Carcinogenesis, Vol. 3: Polynuclear Aromatic Hydrocarbons. P.W. Jones, and R.I. Freudenthal (eds.). New York, Raven Press, 1978, p. 175-182.

Information Source: H. Hertz, US Dept. of Commerce, National Bureau of Standards, Washington, D.C. 20234.

R-067-78

INDUSTRIAL WASTE CHARACTERIZATION

Principal Investigator:	Hunter, J.V., and S.D. Faust
Performing Organization:	Rutgers The State University, Agricultural Experiment Station, Old Queens Bldg, New Brunswick, NJ 08903
Supporting Agency:	New Jersey State Government, Trenton, NJ. No. 0060400, NJ 00535
Period:	10/77 - 9/78

Hydrocarbons, Contaminants, Oxidation, Chemical analysis, Sediments, Uptake, Crankcase oil, Delaware, *Characterization

The project objective is to "conduct kinetic studies on the chemical oxidation of selected organophosphates, carbamates, ureas, amides, and arsenicals wherein the detection and identification of partial oxidation products." Results have included: indication of the presence of naphthalene and other compounds in Delaware sediment; demonstration of hydrocarbon uptake by oysters in controlled experiments; and characterization of petroleum-derived aromatic hydrocarbons in stormwater and Delaware River sediments, with analysis indicating crankcase oil as the source.

[SSIE No. GY-60400-5]

R-068-78 (R-076-77)

ENVIRONMENTAL SUPPORT TECHNOLOGY - TRACE GASES IN THE MARINE ENVIRONMENT

Principal Investigator: Swinnerton, J.W., and W.D. Smith
Performing Organization: US Navy, Research Laboratory, Washington, D.C. 20375
Supporting Agency: Same as above. No. DN620141
Period: 10/77 - 9/78

Chemical analysis, Hydrocarbons, Oceans, Marine organisms, *Trace gases

The objectives of this project are "to develop and utilize shipboard and *in situ* methods for measuring the concentrations of gases and hydrocarbons in ocean and atmosphere in order to better assess pollution in the marine environment, to minimize underwater corrosion and to determine the relationships of dissolved gases to marine biota."

[SSIE No. ZQN-620141-4]

R-069-78 (R-010-77)

OIL IN WATER TECHNOLOGY

Principal Investigator: Venezky, D.L.
Performing Organization: US Navy, Research Laboratory, Washington, D.C. 20375
Supporting Agency: US Dept. of Defense, Navy, Naval Supply Systems Command, Washington, D.C. 20376. No. DN580168
Period: 10/77 - 9/78

Detection, Hydrocarbons, Analytical techniques, USN, *Oil/grease in water

In order to maintain naval expertise in the area of oil-in-water detection and assaying, the Naval Research Laboratory (NRL) has participated in reviewing and evaluating test methods which are submitted or proposed to the American Society for Testing and Materials, Committee D-19, and its task group on oil/grease in water. Oil and grease components are being identified, and methods developed to distinguish between soluble non-ionic and soluble ionic hydrocarbons in water.

[SSIE No. ZQN-580168-2]

R-070-78 (R-069-76)
DEVELOPMENT OF ANALYTICAL METHODS
Principal Investigator: Warner, J.S.
Performing Organization: Battelle Columbus Laboratories, 505 King Ave, Columbus, OH 43201
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 212-75
Period: Unknown

Analytical techniques, Hydrocarbons, Seawater, Sediments, *Animal tissues

The objective of this project is to continue to develop and validate methods for determining petroleum components in water, sediments, and marine animal tissues.

Status: A draft technical report has been submitted on all analytical methodology developed.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Reports and Publications

DETERMINATION OF ALIPHATIC AND AROMATIC HYDROCARBONS IN MARINE ORGANISMS
Warner, J.S. 1976.
Analytical Chemistry 48(3):578-583.

[For summary see OPR May 76-July 76:#C-1307-76.]

Information Source: J.S. Warner, Battelle Columbus Laboratories, 505 King Ave, Columbus, OH 43201.

6. SOURCE IDENTIFICATION

[No entries.]

B. OIL POLLUTION PREVENTION AND CONTROL

1. SPILL CONTAINMENT

[No entries.]

2. CLEANUP AND REMOVAL

R-071-78
DISPERSANT EFFECTIVENESS
Principal Investigator: Unknown
Performing Organization: Unknown
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 311-78
Period: 10/78 - ?

Dispersants, Dispersions, Spill cleanup, Fate

This project proposes to: 1) photograph and study oil dispersion after actual or test spills; 2) compare spills dispersed by conventional and self-mix dispersants with spills dispersed by natural means; and 3) compare fate and effects of the control and test spills.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-072-78
FATE OF OIL IN THE MARINE ENVIRONMENT: DILUTION STUDY OF A CONTROLLED OIL SPILL THAT HAS BEEN CHEMICALLY DISPERSED
Principal Investigator: Unknown
Performing Organization: JBF Corporation, Lakeside Office Park, Wakefield, MA 01880
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 222-76
Period: Unknown

Fate, Dispersants, Dispersions, Spill cleanup

This project has been proposed to determine the effect of chemical dispersant treatment on the rate of dilution and other disappearance mechanisms of an oil spill. It is also intended that this research will support dispersant usage where appropriate.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-073-78
RECOVERY OF FLOATING HAZARDOUS MATERIALS USING FOAMS AND GELS - PHASE II

Principal Investigator:	Unknown
Performing Organization:	Mason & Hanger-Silas Mason Co., 200 W. Vine St., Lexington, KY 40507
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab, Cincinnati, OH 45268. Contract 68-03-0490, B610A-586
Period:	10/76 - 9/77
Funds:	$60,000

Spill cleanup, Booms, Skimmers, Sorbents, Evaporation, *Foams, *Gels

An evaluation of the effect of gelling agents and foams on the performance of conventional oil spill control and removal equipment is being conducted at EPA's OHMSETT facility. Booms and skimmers will be tested in octanol, naphtha and dioctylphthalate; and the evaporation of these materials will be monitored to determine if evaporation enhancement or suppression results.

[SSIE No. GMA-4619]

R-074-78
DISPERSANT APPLICATION METHODS

Principal Investigator:	Unknown
Performing Organization:	Southern California Outer Continental Shelf Co-op (SC-PCO)
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 310-78
Period:	10/78 - ?

Dispersants, Equipment, Sampling, Spill cleanup, *Application

Project objectives involve: 1) testing application techniques for self-mixing and conventional dispersants from aircraft and vessels; 2) performing field demonstrations in "real world" tests; and 3) developing proper dispersant application at varying rates using correct droplet size. Factors of wind speed, sea conditions, and equipment available will be considered.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-075-78

ENHANCED RECOVERY OF UNDERGROUND LEAKED OR SPILLED GASOLINE

Principal Investigator: Unknown
Performing Organization: Texas Research Institute
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 309-77
Period: ? - 12/78

Spill removal, Gasoline, Sediments, Surfactants, *Underground recovery

"Environmentally acceptable" surfactants and displacement agents are being tested for their enhancement of the recovery of underground leaked or spilled gasoline. The liquid agents release and transport gasoline that has been absorbed by typical subsurface sediments.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-076-78

MOP OIL SPILL DISPERSANTS

Principal Investigator: Unknown
Performing Organization: Woodward & Clyde Consultants, 2 Embarcadero Center, Suite 700, San Francisco, CA 94111
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab, Cincinnati, OH 45268. Contract 68-03-2621, B623C-272
Period: 10/76 - 9/77
Funds: $21,000

Dispersants, Spill removal, Manuals, Pollution prevention, Safety, Birds, Environmental protection

This research was contracted for the development of a "first generation manual of practice for environmentally acceptable utilization of oil spill dispersants to 'prevent or substantially reduce explosion or fire hazard to property,' or 'prevent or reduce substantial hazard to a major segment of the populations or vulnerable species of waterfowl,' or 'result in least overall environmental damage, or interference with designated water use.'" A literature survey will be conducted to establish guidelines and criteria to implement Annex X (Schedule of Chemicals and other Addititves to Remove Oil and Hazardous Substances Discharge) of the National Oil and Hazardous Substances Pollution Contingency Plan [CFR 40(28), February 10, 1975]. The product of this research will be the identification of the proper use of dispersants, field methods, equipment, techniques, and application experts for their use in an "environmentally acceptable manner." Decision information will be benefitted by testing of dispersant products.

[SSIE No. GMA-4634]

R-077-78

REMOTE CONTROL HOVERCRAFT OR VEHICLE TO PLUG HAZARDOUS LEAKS

Principal Investigator: Gustafson, H.A.
Performing Organization: Oxnard City Fire Dept., 305 W. 3rd St., Oxnard, CA 93030
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268, No. R805365-01, B610A-212
Period: 1/77 - 6/78
Funds: $50,000

Equipment, Surveillance, Leakage, Pollution control, Safety, Design-engineering, *Remote control hovercraft

"The grantee has proposed a two-phase effort to design, develop, test, and evaluate a remotely piloted, centrifugal fan thrust propelled, jet skirt nozzle forward/side motion controlled, moderate weight, hovercraft-type of vehicle for moving into a hazardous spill contaminated area over rough terrain and pipe runs (as well as over flat land) to carry an on-board TV camera and one or more remotely operated devices for plugging leaks, crimping pipes, turning valves, etc. close to the site or origin of the spill and thereby to reduce the risk to response personnel in acquiring factual data on the spill or in undertaking control measures."

[SSIE No. GMA-3732]

Status: The remote control Hovercraft, in its initial phase, is designed as a surveillance vehicle. If funding becomes available, a late phase to include leak plugging and limited mechanical task performance is planned.

Information Source: R. Furr, Assistant Chief, City of Oxnard, Fire Dept., 251 South C St., Oxnard, CA 93030.

Reports and Publications

DEVELOPMENT OF A REMOTELY OPERATED VEHICLE TO CONTROL HAZARDOUS MATERIAL SPILLS
Seemann, G.R., G.L. Harris, N.K. Souter, M.V. Scherb, and H.A. Gustafson. n.d.
Miami Conference for the Control of Hazardous Material Spills, 1978. (In press?)

Information Source: N.K. Souter, Developmental Sciences, Inc., 15747 East Valley Blvd, P.O. Box 1264, City of Industry, CA 91749.

3. OIL TRANSFER AND TRANSPORT

R-078-78
PUGET SOUND ESA PROJECT
Principal Investigator: Foxworthy, B.L.
Performing Organization: US Dept. of the Interior, Geological Survey, 1305 Tacoma Ave. S, Tacoma, WA 98402
Supporting Agency: US Dept. of the Interior, Geological Survey, Office of Land Information & Analysis, 12201 Sunrise Valley Dr., Reston, VA 22092
Period: 7/75 - 6/76

Oil transport, Production, Environmental protection, Puget Sound

Project objectives are "to collect, interpret, and disseminate earth-sciences information in a relevant form to meet critical planning and decision-making needs. Emphasis will be on critical data needs for energy transport and production and environmental protection related to increased petroleum shipment through Puget Sound and adjacent marine waters."

[SSIE No. ZUA-4536]

R-079-78 (R-032-78)
OFFSHORE PIPELINES
Principal Investigator: Herbich, J.B..
Performing Organization: Texas A&M University, Department of Civil Engineering, College Station, TX 77843
Supporting Agency: National Oceanic and Atmospheric Administration, Dept. of Commerce, Washington, D.C. 20230. No. SP-1
Period: 1/76 - 12/76

Pipelines, Offshore development, Design-engineering, Pollution prevention

Objectives include: 1) determining the dominant parameters which affect pipeline dynamics and stability; and 2) developing new or improved design criteria to minimize the high failure rate of offshore pipelines.

[from Maritime Research Information Service Abstracts Vol. 15:#15 141176. 1977.]

Reports and Publications

INFLUENCE OF THE SUPRA-MOLECULAR MARINE ENVIRONMENT ON PITTING CORROSION
Harris, D.B., B.M. Gallaway, and J.B. Herbich. 1976.
TAMU-SG-76-211. Report no. COE 192, Aug 1976.

SCOUR AROUND MODEL PIPELINES DUE TO WAVE ACTION
Herbich, J.B. 1976.
Conference on Coastal Engineering, 15th, Honolulu, Hawaii, 1976.

SHORE PROTECTION
Herbich, J.B., and R.E. Schiller, Jr. 1976.
Marine Advisory Bulletin, TAMU-SG-76-504, Feb 1976.

WAVE-INDUCED SCOUR AROUND OFFSHORE PIPELINES
Herbich, J.B. 1977.
Offshore Technology Conference, 9th, Houston, Texas, May 2-5, 1977. Vol. 4:79-90.

WHAT IS OCEAN ENGINEERING?
Herbich, J.B. 1977.
Ocean Resources Engineering, Feb 1977.

FOUNDATION STABILITY OF BURIED OFFSHORE PIPELINES. A SURVEY OF PUBLISHED LITERATURE
Manley, R.N., and J.B. Herbich. 1976.
TAMU-SG-76-204, Project report no. COE 174, Feb 1976.

Information Source: J.B. Herbich, Hydromechanics Laboratories, Civil Engineering Dept., Texas A&M University, College Station, TX 77843.

4. WASTE TREATMENT AND DISPOSAL

R-080-78
REFINERY SOLID WASTE DISPOSAL SURVEY
Principal Investigator: Unknown
Performing Organization: American Petroleum Institute; Engineering Science, Inc., Austin, TX
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 801-75
Period: '75 - '78 (est.)

Solid wastes, Disposal, Refineries, Regulations, Wastewater treatment, *Data base

Solid wastes produced by refinery operations, and handling, treatment, and disposal practices have been surveyed to provide a data base for use in the establishment of solid waste effluent discharge regulations for petroleum refining operations.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Status: The survey has been completed and the final report which is in preparation will be published in 4 sections: 1) Solid Waste Quantities; 2) Solids Management Practices; 3) Metallic Constituents in Solid Wastes; and 4) Non-metallic Constituents in Solid Wastes.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-081-78

HEALTH EFFECTS OF CONSUMPTION OF RENOVATED WATER - CHEMISTRY AND CYTOTOXICITY

Principal Investigator: Chappell, W.R., H. Walton, C. Solomons, and W. Weston
Performing Organization: University of Colorado, School of Arts & Sciences, 1200 Univeristy Ave, Boulder, CO 80302
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Health Effects Research Lab, Cincinnati, OH 45268. No. R803968-02, D614B-078
Period: 10/76 - 9/77
Funds: $72,033

Wastewaters, Contaminants, Toxicity, Health hazards, Animals, PAH

Various contaminants and groups of contaminants found in renovated wastewaters will be assessed for their occurrence and toxicity. Mammalian cells (platelets and neutrophils) will be used in testing the cytotoxicity of concentrates and their fractions when added to cell cultures *in vitro*. These tests will serve as indicators of the most important chemical groups and compounds, first by being primary toxicity screens, and second by separating the concentrates into various chemical classes (including PAHs). [possibly oil pollution related]

[SSIE No. GMA-3310-1]

R-082-78 (R-046-76)

THE EFFECT ON WATER QUALITY AND AQUATIC ORGANISMS OF "BEST PRACTICABLE TECHNOLOGY" REFINERY EFFLUENT TREATMENT

Principal Investigator: Dorris, T.C., S.L. Burks, and J.L. Wilhm
Performing Organization: Oklahoma State University, Reservoir Research Center, Life Sciences West 427, Stillwater, OK 74074
Supporting Agency: US Dept. of the Interior, Office of Water Research & Technology, 19th & C Sts. NW, Washington, D.C. 20240. No. B-033-OKLA
Period: 10/76 - 9/77

Wastewater treatment, Refineries, Bioassay, Fish, Activated sludge, Growth, Phytoplankton, Water quality

Fathead minnows will be used for a continuous flow toxicity bioassay of oil refinery effluents that have been through a secondary activated sludge treatment and dual media filters. The effects of this effluent on the diversity and growth of periphyton diatoms will also be investigated. The treatment process is being evaluated for potential use in control technology.

[SSIE No. GUY-332-1]

R-083-78 (R-029-77)

LAND APPLICATION OF INDUSTRIAL WASTES

Principal Investigator: Overcash, M.R., and P.W. Westerman

Performing Organization: University of North Carolina, School of Agriculture and Life Sciences, Raleigh, VA 27607

Supporting Agency: US Dept. of the Interior, Office of Water Research & Technology, 19th & C Sts. NW, Washington, D.C. 20240. No. B-100-NC

Period: 7/77 - 6/78

Funds: $33,468

Wastewater treatment, Industries, Refining, *Land application

"The proposal objectives are: (1) to coordinate available fundamental and field scale information with actual treatment mechanisms and calculations to determine land loading rates for wastewater constituents of several industry categories [textiles, seafood processing, and petroleum refining]; (2) to optimize the end-of-the-pipe data of objective (1) by including pretreatment unit processes which precede the plant-soil receiver so that minimum cost is achieved for the total system and maximum advantage is gained from the land receiver."

[SSIE No. GUY-798-1]

Reports and Publications

PLANT-SOIL ASSIMILATIVE CAPACITY FOR OILS

Pal, D., and M.R. Overcash. n.d.

AIChE National Meeting, 85th, Philadelphia, Pennsylvania, June 1978. Preprint.

Information Source: M.R. Overcash, University of North Carolina, School of Agriculture & Life Sciences, Raleigh, NC 27607

R-084-78 (R-050-77)

US NAVY OILY WASTE HANDLING PROGRAM: DEVELOPMENT OF LEGAL COST EFFECTIVE BULK FUEL STORAGE TANK STRIPPING SYSTEM

Principal Investigator: Strandell, P.A., and J.W. Taylor

Performing Organization: US Navy, Ship Research and Development Center, Annapolis, MD 21402

Supporting Agency: US Dept. of Defense, Navy, Naval Supply Systems Command, Washington, D.C. 20376. No. DN778141

Period: 10/77 - 9/78

Oil tanks, Storage, Oil-water separation, Reclamation, USN, Design-engineering, *Tank cleaning

The investigators propose to develop an automated system that will purge fuel storage tanks of water and dirt to Navy acceptable levels, separate oil from the effluent for reclamation and legally discharge the water and dirt to the environment in a cost-effective manner.

[SSIE No. ZQN-778141-1]
[for Reports and Publications see OPR May 77-July 77:p.248-249]

5. OIL-WATER SEPARATION

[No entries.]

6. RECLAMATION AND REUSE

[No entries.]

7. PERSONNEL TRAINING AND EDUCATION

[No entries.]

8. CONTINGENCY PLANNING

[No entries.]

9. PREVENTION AND CONTROL MEASURES

R-085-78 (R-052-77)
OIL POLLUTION CONTROL AT MILITARY INSTALLATIONS
Principal Investigator: Fileccia, R.J.
Performing Organization: US Army, Construction Engineering Research Lab, P.O. Box 4005, Champaign, IL 61820

Supporting Agency: Same as above. No. DAOS8126
Period: 10/77 - 9/78

Oil discharges, Sources, Chemical effects, Pollution control, *Military installations

"Several Class I installations will be surveyed to determine the cause, magnitude, and chemical nature of oily discharges from facility operations. Based on the findings of the survey, recommendations for minimizing, treating, or eliminating these waste discharges will be formulated for demonstration in the field."

[SSIE No. ZQA-198126-1]

R-086-78 (R-296-75)
ENVIRONMENTAL SUPPORT TECHNOLOGY: INTERFACE CHEMISTRY IN THE MARINE ENVIRONMENT AND ITS EFFECT ON NAVAL OPERATIONS

Principal Investigator: Garrett, W.D., and W.R. Barger
Performing Organization: US Navy Research Laboratory, Washington, D.C. 20375
Supporting Agency: Same as above. No. DN020190
Period: 10/77 - 9/78

Oil slicks, Pollution control, USN, Ships, Sea surface, *Interface chemistry

Objectives of the project are to enhance naval operations by chemical modification of the air-sea interface; to evaluate the role of natural, artificial, and pollutant surface films on air-sea interactions; and to determine the influence of organic films on atmospheric processes. Based on laboratory, test tank, and field experiments, surface-active chemicals have been selected for use as sea markers to control oil pollution at naval ship installations.

[SSIE No. ZQN-20190-4]

R-087-78
CONTRACT SUPPORT SERVICES TO EPIC, VINT HILL FARMS STATION

Principal Investigator: Stout, K.K., and W. Webb
Performing Organization: Trident Engin. Assoc. Inc., 48 Maryland Ave, Annapolis, MD 21401
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab, P.O. Box 15027, Las Vegas, NV 89114. Contract 68-03-2539, J620A-52
Period: 10/76 - 9/77
Funds: $50,700

Source identification, Behavior, Fate, Oil spills, Spill cleanup, Surveillance, Pollution prevention

Project objectives include plans to identify, locate, and delineate point and non-point pollution sources; to determine the behavior and migration of spilled oil and hazardous materials (providing guidance to clean-up operations); and to conduct a search of imagery to monitor for regulations compliance, locate non-filers, and detect "impending environmental episodes."

[SSIE No. GMA-4075]

C. ASPECTS OF OIL POLLUTION

1. BIOLOGICAL ASPECTS

R-088-78
LABORATORY BIOASSAY FOR MORE REALISTIC AND ACCURATE ASSESSMENT OF THE EFFECTS OF CHEMICALLY DISPERSED OIL ON MARINE LIFE
Principal Investigator: Unknown
Performing Organization: Unknown
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St., NW, Washington, D.C. 20037. No. 231-78
Period: Unknown

Dispersants, Biological effects, Marine organisms, Toxicity, Bioassay

The research proposal is to determine the effect of chemically dispersed oil on marine organisms as compared to untreated oil in a laboratory simulation.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Status: This project has not been implemented yet.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-089-78
PHYTOTOXICITY STUDIES - VALDEZ
Principal Investigator: Alexander, V.A.
Performing Organization: University of Alaska, Institute of Marine Science, Fairbanks, AK 99701
Supporting Agency: Alyeska Pipeline Service Co., Inc., 1835 S. Bragaw St., Anchorage, AK 99150
Period: 10/76 - 9/77

Ballast, Phytoplankton, Toxicity, Monitoring, Alaska

The potential impact of low concentrations of oil and/or ballast water on phytoplankton community dynamics will be determined. The impact will be monitored in the vicinity of the diffuser output.

[SSIE No. DA-81]

R-090-78
OIL STRESSES ON WETLAND MACROFAUNA
Principal Investigator: Bahr, L.M.
Performing Organization: Louisiana State University Systems, Center for Wetland Resources, University Station, Baton Rouge, LA 70803
Supporting Agency: US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/HSE-6
Period: 10/76 - 9/77
Funds: $8,120

Marshes, Fish, Invertebrates, Contamination, Chronic effects, Bioindicators

The objective of this project is to assess the effects of chronic oil contamination on marsh macroconsumers, especially juvenile fish and benthic invertebrates, in terms of species diversity and population density. Index organisms which can be used to discriminate between stressed and unstressed areas will be identified.

[SSIE No. GBP-2865]

R-091-78 (R-273-75)
MEASUREMENT OF POLYNUCLEAR AROMATICS (PNA'S) IN MARINE ANIMALS
Principal Investigator: Brown, R.A., and F.T. Weiss
Performing Organization: Exxon Research and Engineering Co., Linden, NJ
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 207-76
Period: ? - 3/79

Aromatic hydrocarbons, Carcinogens, Marine organisms, Health hazards, Toxicity, *PNA

The object of this research is to determine concentrations of PNA's--some of which are carcinogenic--in marine animal tissues and in common foodstuffs.

Status: The PNA method developed under this project (detecting ppb levels) is being used for comparison of the concentrations in shellfish and finfish vs lettuce, potatoes, mushrooms, and smoked meats. Diagnostic techniques have also determined that the PNA's in marine animal tissues do not originate from a petroleum source. The following position paper will be issued.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Reports and Publications

FATE AND EFFECTS OF POLUNUCLEAR AROMATIC HYDROCARBONS IN THE AQUATIC ENVIRONMENT
Brown, R.A., and F.T. Weiss. In press.
American Petroleum Institute Publication No. 4297.

Information Source: C.F. Frandsen, API, 2101 L St. NW, Washington, D.C. 20037.

R-092-78

EFFECT OF PETROLEUM HYDROCARBONS ON FATTY ACID METABOLISM IN MARINE FISHES

Principal Investigator: Caldwell, R.S., and E.M. Calderone
Performing Organization: Oregon State Higher Education System, School of Agriculture, 126 Agriculture Hall, Corvallis, OR 97331
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab, 200 SW 35th St., Corvallis, OR 97330. No. R805625-01, M627-109
Period: 10/76 - 9/77
Funds: $10,757

Fish, Hydrocarbons, Sublethal effects, Metabolism, *Temperature

This research is part of a multi-part project. For project objectives see this issue OPR:#R-093-78.

[SSIE No. GMA-4504]

R-093-78

POSSIBLE SUBLETHAL EFFECT OF PETROLEUM HYDROCARBONS ON THE PHYSIOLOGY OF TEMPERATURE ACCLIMATION IN MARINE FISHES

Principal Investigator: Caldwell, R.S., and E.M. Calderone
Performing Organization: Oregon State Higher Education System, School of Agriculture, 126 Agriculture Hall, Corvallis, OR 97331
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab, 200 SW 35th St, Corvallis, OR 97330. No. R805625-01, M625A-038
Period: 10/76 - 9/77
Funds: $74,000

Fish, Hydrocarbons, Sublethal effects, Metabolism, *Temperature

"The proposed research will test the hypothesis that petroleum hydrocarbon compounds capable of inducing microsomal mixed function oxidases in fish tissues interfere with normal patterns of fatty acid metabolism, specifically microsomal fatty acid desaturation, and that such effects result in modified fatty acid patterns in membrane phospholipids of fish and suboptimal physiological responses to temperature."

[SSIE No. GMA-4224]

R-094-78
ASSESSMENT OF MARINE BIRD POPULATIONS IN PORT VALDEZ AND PRINCE WILLIAM SOUND
Principal Investigator: Derksen, D.V., and M. Jacobson
Performing Organization: US Dept. of the Interior, Fish & Wildlife Service, 4454 Business Park Blvd., Anchorage, AK 99503
Supporting Agency: US Dept. of the Interior, Fish & Wildlife Service, Washington, D.C.
Period: 10/76 - 10/77

Birds, Chronic effects, Beaches, Biological effects, Alaska

Project objectives include: determination of the vulnerability of marine birds to chronic long-term contamination by oil spills from the Trans-Alaska Pipeline; monitoring of population levels of resident and wintering birds in the title areas; and assessment of shorebird use of beach and tidal flat areas that risk oil pollution.

[SSIE No. ZUV-202]

R-095-78 (R-096-76)
LOBSTER LARVAE STUDIES
Principal Investigator: Forns, J.E.
Performing Organization: Westinghouse Ocean Research Laboratory, San Diego,
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 220-76
Period: Unknown

Crustaceans, Behavior, Growth, Development, *Larvae, *Homarus americanus

This study is designed to determine whether larval lobsters (Homarus americanus) are vulnerable to an oil spill during their early developmental stages. Monitoring of exposed animals was conducted 6 times daily for feeding behavior. mobility, molting success, growth and development times to reach the fourth larval stage. Post-larval development was also examined, and hydrocarbon analyses were conducted.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-096-78

LONG-TERM EFFECTS OF SEDIMENT ADSORBED-PETROLEUM HYDROCARBONS ON AQUATIC CHEMICAL AND BIOLOGICAL SYSTEMS

Principal Investigator:	Ho, C.
Performing Organization:	Louisiana State University Systems, Center for Wetland Resources, University Station, Baton Rouge, LA 70803
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/HSE-7
Period:	10/76 - 9/77
Funds:	$20,000

Hydrocarbons, Biogenic hydrocarbons, Sedimentation, Adsorption, Environmental effects, Estuaries, Monitoring

Objectives of this project are: (1) to quantitatively differentiate biogenic hydrocarbons in sediments and biological tissues from petroleum hydrocarbons; "(2) to measure the rate of release of petroleum hydrocarbons on various adsorbents as influenced by chemical nature of adsorbent surfaces; (3) to determine the long-term effect of sediment-sorbed petroleum hydrocarbons on chemical changes in estuarine environment; (4) to determine the effect of surface-adsorbed petroleum hydrocarbons on the biochemical changes in adult organisms and on their larval development; and (5) to develop a new monitoring program for water, sediments and biological systems in estuaries where potential hydrocarbon stress is eminent."

[SSIE No. GBP-2963]

Status: Preliminary investigations are complete but further studies are not planned.

Information Source: C.L. Ho, 1101 Cripple Creek Dr., Austin, TX 78758.

R-097-78

EFFECTS OF OIL ON TUNDRA PONDS

Principal Investigator:	Hobbie, J.E., and S.C. Mozley
Performing Organization:	Marine Biological Laboratory, Woods Hole, MA 02543
Supporting Agency:	US Energy Research & Development Administration, Division of Biomedical & Environmental Research, 1717 H St., NW, Washington, D.C. 20545. Contract ET-76-S-02-2989
Period:	10/77 - 9/78
Funds:	$55,000

Crude oil, Algae, Zooplankton, Benthos, Biological effects, Arctic, *Tundra ponds

The purpose of this study is evaluation of the effects of a crude oil spill on a shallow tundra pond. Photosynthesis, microbial activity, and the populations, species, and life cycles of algae, zooplankton, and bottom animals are being studied.

Status: Results disclose significant damage: zooplankton were the most sensitive organisms and did not grow again in the oiled pond for 6 yrs; algal photosynthesis was depressed by 90% or more for several weeks after the experimental spill, but species composition changed due to the zooplankton mortality; and benthic midge larvae were prevented from metamorphosing to adults.

[SSIE No. GPE-6121]

R-098-78

FATE AND EFFECTS OF CRUDE OIL SPILLS ON BLACK FOREST DOMINATED TUNDRA

Principal Investigator:	McFadden, T.T., C. Collins, F. Deneke, T. Jenkins, et al.
Performing Organization:	US Army, Cold Regions Research and Engineering Lab, Bldg 4070, Fort Wainwright, AK 99703
Supporting Agency:	US Environmental Protection Agency, 401 M St. SW, Washington, D.C. 20460
Period:	10/77 - 9/78

Crude oil, Fate, Environmental effects, Decomposition, Plants, Arctic, *Tundra

The ultimate fate and environmental effects of crude oil spills on permafrost-underlain black spruce dominated tundra are being investigated. The ultimate fate of oil and decomposition products and their effects on the permafrost table and vegetation will also be determined.

[SSIE No. GMA-4455]

R-099-78

NAVY ENVIRONMENT: BACTERIAL CHEMOTAXIS AS A BIOINDICATOR OF MARINE POLLUTION

Principal Investigator:	Mitchell, R., and G. McKay
Performing Organization:	Harvard University, School of Engineering, Cambridge Station, Cambridge, MA 02138
Supporting Agency:	US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. No. DN923411, Contract N00014-76-C-0262
Period:	10/77 - 9/78
Funds:	$20,000

Crude oil, Contaminants, Seawater, Sublethal effects, Microorganisms, Bacteria, *Chemotaxis

Recent research suggests that crude oil possesses some limited solubility in seawater and may have an inhibitory effect on chemoreception in marine bacteria. Laboratory and field studies are being conducted to investigate inhibition of bacterial chemotaxis by chloramines, the relationship between chemoreceptor blockage by pollutants and retardation of organic matter decomposition, and pollution-induced microbial diseases of coral.

[SSIE No. GQN-923411-8]

R-100-78
BIOLOGICAL FIELD STUDIES ON THE EFFECTS OF OIL ON MARINE ANIMALS
Principal Investigator: Neff, J.M., and H. Armstrong
Performing Organization: Texas A&M University, School of Science, College Station, TX 77843
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 206-76
Period: Unknown

Crude oil, Hydrocarbons, Invertebrates, Fish, Biological effects, Behavior, Development, Growth

The objective of this research was to determine the effects of crude and refined petroleum and specific hydrocarbons on the behavior, development, and growth of marine invertebrates and fish.

Status: The project is complete and a draft final report has been submitted. Results of laboratory studies indicate that: oceanic crab larvae are not significantly more sensitive to chronic low-level oil exposure than are tidal species; the accumulation of petroleum hydrocarbons by clams is inversely related to temperature; and fish embryos cannot tolerate continuous exposure to low levels of petroleum but can recover after exposure of up to 8 days.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-101-78
EFFECTS OF PETROLEUM HYDROCARBONS AND DRILLING MUD ON CORAL REEFS
Principal Investigator: Neff, J.M.
Performing Organization: Texas A&M University, School of Science, College Station, TX 77843
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 215-75, 215-76
Period: Unknown

Hydrocarbons, *Drilling mud, Coral reefs, Uptake, Release, Growth, Sedimentation, Food web

The project objective was "to determine whether spilled oil or drilling mud occurring in offshore areas represents a serious threat to coral reef communities." Specific aspects under examination included whether corals concentrate hydrocarbons in their tissues - thus affecting the food web, whether corals clean themselves of drilling mud, whether hydrocarbons and drilling mud affect their growth rate, and how much sedimentation by drilling mud they can withstand.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-102-78 (R-015-77)

EFFECT OF CRUDE OIL ON NITROGEN FLUX IN SALT MARSHES

Principal Investigator:	Patrick, W.H., and R. Delaune
Performing Organization:	Louisiana State University Systems, School of Agriculture, University Station, Baton Rouge, LA 70803
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/HSE-3
Period:	10/76 - 9/77
Funds:	$8,395

Crude oil, Biological effects, Sediments, Plants, Marshes, *Nitrogen flux, *Spartina alterniflora

Studies are being conducted to determine: 1) the effect of crude oil on the nutrient chemistry of wetland soils and sediments and 2) the effect of crude oil on biological activity of sediment as measured by CO_2 and methane production. Specific aspects examined are the effects of crude oil on the uptake of plant nutrients by Spartina alterniflora, on the various components of the N cycle, and on sediment oxidation-reduction processes. Preliminary results indicate a tolerance level of up to 1 L of oil/m^2 for mature Spartina alterniflora plants.

[SSIE No. GBP-2402-1]

R-103-78

COASTAL ENVIRONMENTAL ASSESSMENT STATION

Principal Investigator:	Phelps, D.K., and W.B. Galloway
Performing Organization:	US Environmental Protection Agency, Science & Technology Division, S Ferry Rd., Narragansett, RI 02882
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab, S Ferry Rd., Narragansett, RI 02882. No. P608C-30
Period:	10/76 - 9/77
Funds:	$76,000

Biological effects, Marine organisms, Food web, Coasts, Bioindicators, *Mytilus edulis

The primary objective of the Coastal Environmental Assessment Station (CEAS) project is to develop methodology for the direct assessment of the impact of anthropogenic input to the coastal environment or marine organisms, especially organisms which are part of the food chain to man. Mytilus edulis are used as bioindicators in control and contaminated areas. Hydrocarbon body burden is one measurement of pollution.

[SSIE No. ZMA-1471]

R-104-78
TUMORS IN MARINE ANIMALS

Principal Investigator:	Saila, S.
Performing Organization:	University of Rhode Island
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 221-77, 221-78
Period:	? - 12/78

Marine organisms, Mollusks, Hydrocarbons, Contaminants, *Tumors

A field survey is being conducted to define the occurrence of tumors in marine animals, primarily quahog clams, as influenced by various pollutants, particularly petroleum hydrocarbons. The cause of the disorder and effect transference of the disease will also be investigated.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Information Source: C.F. Frandsen, API, 2101 L St. NW Washington, D.C. 20037.

R-105-78
EFFECTS OF MIXED PETROLEUM HYDROCARBONS IN MARINE FISHES

Principal Investigator:	Stegeman, J.J., and D.J. Sabo
Performing Organization:	Woods Hole Oceanographic Institute, Main St., Woods Hole, MA 02543
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/B-5
Period:	10/76 - 9/77
Funds:	$71,500

Hydrocarbons, Fish, Metabolism, Chronic effects

This project will determine and assess: 1) the effects of low levels of petroleum hydrocarbons on carbohydrate and lipid metabolism and cellular structure in various tissues of marine fish, including larval and juvenile fish, 2) processes related to hormone action and membrane function which may mediate or accompany the above effects, 3) the rate of hydrocarbon metabolism and the response of hydrocarbon metabolizing cytochrome P-450 systems in marine fish to low levels of petroleum hydrocarbon contamination, and 4) classes of petroleum hydrocarbons responsible for the above effects.

Status: Results so far have demonstrated that 1) chronic exposure alters hepatic lipid metabolism, 2) effects on energy and lipid metabolism for a given tissue are similar among different fish species, but are different in liver, gill, muscle, and brain tissues, 3) contamination effects are altered by prior contamination, and 4) the hydrocarbon metabolizing system in fish is the same as that in mammals.

[SSIE No. GBP-2481-1]

R-106-78 (R-014-78)

ECOLOGICAL, PHYSIOLOGICAL, AND TOXICOLOGICAL EFFECTS OF OIL ON BIRDS

Principal Investigator:	Stickel, L.F.
Performing Organization:	US Dept. of the Interior, Fish and Wildlife Service, Laurel, MD 20811
Supporting Agency:	US Dept. of the Interior, Fish and Wildlife Service, Division of Population Reg. Res.; No. 85-830-9285-000
Period:	10/76 - 9/77
Funds:	$440,000

Birds, Sublethal effects, Toxicity, Guidelines

The effect of sublethal exposure of birds on oil will be studied by correlating experimental and ecological studies that relate toxicological/physiological effects and kinetics of oil in birds to exposure in the environment. Recommendations will be made for guidelines to levels of oil in the environment that are dangerous to the welfare of wild bird populations.

[SSIE No. ZUV-82]

Reports and Publications

EFFECTS OF NO. 2 FUEL OIL ON COMMON EIDER EGGS
Albers, P.H., and R.C. Szaro. 1978.
Marine Pollution Bulletin 9(5):138-139.

THE EFFECTS OF PETROLEUM ON DIFFERENT STAGES OF INCUBATION IN BIRD EGGS
Albers, P.H. 1978.
Bulletin of Environmental Contamination and Toxicology 19(5): 624-630.

EXPOSURE OF MARINE BIRDS TO ENVIRONMENTAL POLLUTANTS
Ohlendorf, H.M., R.W. Risebrough, and K. Vermeer. 1978.
Washington, D.C., US Dept. of the Interior, Fish and Wildlife Service, 1978. 40p. (Wildlife Research Report 9)

Information Source: L.F. Stickel, US Dept. of the Interior, Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD 20811.

R-107-78

MUSSEL COMMUNITY STUDY

Principal Investigator: Straughan, D.
Performing Organization: University of Southern California, Allan Hancock Foundation, University Park, Los Angeles, CA 90007
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 22037. No. 217-77
Period: Unknown

Mollusks, Natural seepage, Chronic effects, Sediments, Intertidal zone, Sampling

This project assessed the effects of chronic exposure to natural seep oil on an intertidal mussel community structure. Sampling was done at three differing exposure sites. In the community analysis, 75-99% of the species present were sampled, and mussel tissue and sediments were examined.

Status: A final report is being prepared.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-108-78

DETERMINE NEARSHORE MARINE & ESTUARINE ECOSYSTEM EFFECTS ASSOCIATED WITH THE DISCHARGE OF TREATED MUNICIPAL AND INDUSTRIAL WASTEWATERS

Principal Investigator: Swartz, R.
Performing Organization: US Environmental Protection Agency, Environmental Research Lab, 200 SW 35th St., Corvallis, OR 97330
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab, 200 SW 35th St., Corvallis, OR 97330. No. M608C-069
Period: 10/76 - 9/77
Funds: $30,000

Bioindicators, Wastewaters, Refineries, Mollusks, Crustaceans, Biological effects, Pacific Ocean

Clam, oyster, mussel and crab larvae will be used as indicators of the adverse effects of CMT materials in pulp mill and refinery effluents in Pacific northwest marine waters.

[SSIE No. ZMA-1378]

R-109-78 (R-061-77)

FATE AND EFFECTS OF PETROLEUM HYDROCARBONS AND SELECTED TOXIC METALS IN SELECTED MARINE ECOSYSTEMS AND ORGANISMS

Principal Investigator:	Wolfe, D.A.
Performing Organization:	US Dept. of Commerce, Environmental Research Labs, Boulder, CO 80302
Supporting Agency:	US Environmental Protection Agency, Office of Energy, Minerals, & Industry, 401 M St. SW, Washington, D.C. 20460 Interagency No. D6-E693-EM, V625B-33.
Period:	10/76 - 9/77
Funds:	$475,000

Hydrocarbons, Marine organisms, Ecosystems, Fate, Analytical techniques, Environmental effects, Subarctic regions, NOAA, Toxicity

The project includes four tasks with the following objectives: establish a NOAA analytical capability for petroleum hydrocarbons and toxic metals in the marine environment for purposes of standardizing analytical techniques and providing intercalibration services; identify the current status of knowledge and information gaps on the fate and effects of petroleum hydrocarbons in marine ecosystems; select and conduct specific laboratory experiments on fate and effects of metals and hydrocarbons; and conduct controlled experimental ecosystem research to test the ability to predict ecological and biological impacts of petroleum in subarctic ecosystems. Routine analyses of petroleum hydrocarbons in environmental samples are underway at the NOAA National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, WA. Laboratory experiments are being conducted to examine the interactions between hydrocarbons and other pollutants on marine organisms, and to determine the effects of petroleum on: metals in sediments, crab chemoreception, and seabird reproduction.

[SSIE No. GMA-3038-1]

Reports and Publications

EFFECTS OF CHLORINATED BIPHENYLS AND PETROLEUM HYDROCARBONS ON THE ACTIVITY OF HEPATIC ARYL HYDROCARBON HYDROXYLASE OF COHO SALMON (ONCORHYNCHUS KISUTCH) AND CHINOOK SALMON (O. TSHAWYTASCHA) Gruger, E.H., Jr., M.M. Wekell, and P.A. Robisch. 1977. Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 323-331. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

[For summary see OPR Aug 77-Oct 77:#C-1933-77]

THE MORPHOLOGICAL EFFECTS OF PETROLEUM AND CHLOROBIPHENYLS ON FISH TISSUES
Hawkes, J.W. 1977.
Symposium on Environmental Pollutants, Storrs, Connecticutt, June 1-3, 1977. National Academy of Science, in press.

INTERTIDAL SEDIMENT HYDROCARBON LEVELS AT TWO SITES ON THE STRAIT OF JUAN DE FUCA
McLeod, W.D., Jr., D.W. Brown, R.G. Jenkins, and L.S. Ramos. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 385-396. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

[For summary see OPR Aug 77-Oct 77:#C1713-77.]

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA
MacLeod, W.D., Jr., D.W. Brown, R.G. Jenkins, L.S. Ramos, and V.D. Henry. 1976.
NOAA Technical Memorandum ERL MESA-8. 59p.

[For summary see OPR Aug 77-Oct 77:#C-1679-77.]

FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN MARINE ORGANISMS AND ECOSYSTEMS
Wolfe, D.A. (ed.). 1977.
New York, Pergamon Press, 1977. 478p. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

[For summary see this issue OPR.]

Information Source: D.A. Wolfe, US Dept. of Commerce, NOAA, Environmental Research Labs, Boulder, CO 80303.

2. PHYSICAL/CHEMICAL ASPECTS

R-110-78
A FIELD STUDY OF AMOCO CADIZ OIL SPILL - COASTAL PROCESSES AND OIL-SEDIMENT INTERACTION

Principal Investigator:	Hayes, M.O.
Performing Organization:	Research Planning Institute, Inc., 806 Pavillion Ave, Columbia, SC
Supporting Agency:	NOAA, Environmental Research Labs, Boulder, CO 80302
Period:	3/78 - 11/78

Amoco Cadiz spill, Coasts, Dispersions, Beach cleanup, Spill removal, Sedimentation, Behavior

This research project will investigate: "1) the effects of coastal processes on the initial grounding and dispersion of large masses of oil in a variety of coastal environments; 2) short-term removal rates and oil-sediment depositional patterns on beaches and tidal flats; 3) long-term behavior of oil in different coastal environments; and 4) effectiveness of different cleanup procedures including the impact of such procedures on shoreline stability."

Reports and Publications

EFFECT OF COASTAL PROCESSES ON THE DISTRIBUTION AND PERSISTENCE OF OIL SPILLED BY THE AMOCO CADIZ - PRELIMINARY CONCLUSIONS
D'Ozouville, L., E.R. Gundlach, and M.O. Hayes. 1978.
Centre Oceanologique de Bretagne - Special Report, Proceedings of program concerning the consequences of the Amoco Cadiz oil spill on fisheries and ecology, June 7, 1978, Brest, France.

THE AMOCO CADIZ OIL SPILL, A PRELIMINARY SCIENTIFIC REPORT. CHAPTER 4, INVESTIGATIONS OF BEACH PROCESSES
Gundlach, E.R., and M.O. Hayes. In press. NOAA-EPA Special Report.

Information Source: E.R. Gundlach, Coastal Research Division, Dept. of Geology, University of South Carolina, Columbia, SC 29208.

3. SOCIAL/ECONOMIC ASPECTS

[No entries.]

4. ENVIRONMENTAL RESTORATION AND RECOVERY

R-111-78
MARSHLAND RECOVERY STUDIES

Principal Investigator:	Unknown
Performing Organization:	Virginia Institute of Marine Science, Gloucester Point, VA 23062
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 210-77
Period:	'77 - '78 (est.)

Crude oil, Marshes, Estuaries, Acute effects, Food web, Chemical effects, Recovery

The acute environmental effects of oils spilled in coastal tidal-marsh estuaries are being determined at all trophic levels. The transport of major chemical components as well as the biological effects will be studied. Experimental spills of fresh and aged South Louisiana crude oils were conducted in September 1975.

Status: Two years after the spill, residual impacts are still present in marsh grass and benthic populations. Research in 1977 focussed on the biological recovery of the marsh and related analysis.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-112-78 (R-080-76)

SHORELINE PROTECTION AND RESTORATION

Principal Investigator:	Unknown
Performing Organization:	Woodward-Clyde Consultants
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 305-75
Period:	Spring 76 - ?

Shorelines, Marshes, Restoration, Environmental protection, *Surface treatment agents

The project is concerned with the evaluation through "real world" testing of selected surface treatment agents for the protection and restoration of shoreline and salt marsh areas.

Status: Field tests were completed in May 1977, and a draft report has been submitted. EPA has issued a grant to continue the study.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-113-78

EFFECTS OF NO. 2 FUEL OIL ON A SALT MARSH - A QUANTITATIVE THREE-YEAR STUDY OF RECRUITMENT AND GROWTH

Principal Investigator:	Hampson, G.R.
Performing Organization:	Woods Hole Oceanographic Institute, Main St., Woods Hole, MA 02543
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/P-3
Period:	10/76 - 9/77
Funds:	$2,615

Fuel oil, Marshes, Environmental effects, Growth, Recovery, Massachusetts

A 3-yr comparative study of two salt marsh communities was conducted. One site was a severely oiled area in Winsor Cove, Bourne, Massachusetts, and the other was in Chappaquoit, Falmouth, Massachusetts.

Reports and Publications

NO. 2 FUEL OIL SPILL IN BOURNE, MASSACHUSETTS: IMMEDIATE ASSESSMENT OF THE EFFECTS ON MARINE INVERTEBRATES AND A 3-YEAR STUDY OF GROWTH AND RECOVERY OF A SALT MARSH
Hampson, G.R., and E.T. Moul. 1978.
Journal of the Fisheries Research Board of Canada 35(5):731-744.

[For summary see this issue OPR.]

[SSIE No. GBP-2962]

Status: This project is not funded currently, but further studies are planned without official funding.

Information Source: G. Hampson, address above.

5. GENERAL ASPECTS

[No entries.]

D. ASPECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL ASPECTS

R-114-78

EFFECTS OF THE TRANS-ALASKA PIPELINE ON ARCTIC SLOPE WATERBIRDS AND THEIR WETLAND RESOURCES

Principal Investigator:	Derksen, D.V.
Performing Organization:	US Dept. of the Interior, Fish & Wildlife Service, 4454 Business Park Blvd., Anchorage, AK 99503
Supporting Agency:	US Dept. of the Interior, Fish & Wildlife Service, Washington, D.C.
Period:	10/76 - 10/77

Birds, Habitats, Environmental effects, Development, Oil transport, Pipelines, Alaska, *Wetland resources

Research is being conducted "to assess the impact of oil spills, habitat alteration and destruction, vehicular and aircraft activity, and other activities associated with petroleum development and transport on waterbirds and their wetland resources." Also studied will be: chronic effects and rate of recovery of tundra ponds contaminated by experimental oil spills in 1974-1975; the role of melt water in transporting spilled oil over the impermeable tundra during the spring thaw; the impact of water level changes created by various development disturbances on vegetation and macroinvertebrates; monitoring of bird population levels; and the role of barrier islands and lagoons as bird habitats.

[SSIE No. ZUV-203]

R-115-78

ENVIRONMENTAL AND ECOLOGICAL STUDIES OF HIGH ARCTIC MAMMALIAN HABITAT AND FOOD CHAINS AFFECTED BY DEVELOPMENT

Principal Investigator:	Jonkel, C.J.
Performing Organization:	University of Montana, School of Forestry, Missoula, MT 59801
Supporting Agency:	US National Science Foundation, Division of Polar Programs, 1800 G St. NW, Washington, D.C. 20550. No. DPP76-17644
Period:	9/77 - 8/78
Funds:	$93,204

Marine mammals, Animals, Food web, Development, Habitats, Pipelines, Arctic

This international research project with US, Canadian, Danish, Norwegian, and Soviet scientists will study the effect of resources, pipeline, and shipping development pressures on key mammal species, their habitats, and food chains in high arctic regions. The predators selected for study are dominant carnivores at the top of the food chain, are distributed throughout the Arctic Basin, are subject to regional and territorial influences and pressures, and serve as good indicators of the status of the arctic environment.

[SSIE No. CF-829-1]

R-116-78
EFFECTS OF DRILLING MUDS ON MARINE ORGANISMS

Principal Investigator:	Neff, J.
Performing Organization:	Texas A&M University, School of Science, College Station, TX 77843
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 225-77, 225-78
Period:	? - 12/78

Toxicity, *Drilling muds, Marine organisms, Bioassay, Gulf of Mexico

The toxicity of a typical drilling mud to marine animals will be assessed. This research was initiated in response to "unduly restrictive regulations on the handling and disposal of drilling muds in OCS waters."

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Information Source: C.F. Frandsen, API, address above.

R-117-78 (R-039-77)
HYDROCARBON EFFECTS ON ESTUARINE CARBON FLUX

Principal Investigator:	Turner, R.E.
Performing Organization:	Louisiana State University Systems, Center for Wetland Resources, University Station, Baton Rouge, LA 70803
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/HSE-4
Period:	10/76 - 9/77
Funds:	$9,056

Drilling, Estuaries, Phytoplankton, Environmental effects, Louisiana, *Carbon flux

The purpose of this project is to evaluate the effect of long-term oil recovery operations in Louisiana's wetlands on the phytoplankton and macrophyte production there.

Reports and Publications

CUMULATIVE IMPACT OF CANALS IN THE COASTAL ZONE
Craig, N., E. Turner, and J. Day Jr. (in press).
LSU Coastal Zone Management Report.

OIL AND GAS USE CHARACTERIZATION, IMPACTS AND GUIDELINES
Conner, W., J. Stone, L. Bahr, V. Bennett, et al. 1976.
LSU Center for Wetland Resources, Baton Rouge, Sea Grant Publication No. LSU-T-76-007.

INTERTIDAL VEGETATION AND COMMERCIAL YIELDS OF PENAEID SHRIMP
Turner, E. (in press).
American Fisheries Society, Transactions.

COMMUNITY PLANKTON RESPIRATION IN A SALT MARSH TIDAL CREEK AND THE IMPORTANCE OF MACROPHYTIC LEACHATES
Turner, E. (in press).
Limnology and Oceanography.

[SSIE No. GBP-2506-1]

2. PHYSICAL/CHEMICAL ASPECTS

R-118-78
DISSOLVED ORGANIC CARBON IN OIL FIELD SEDIMENTS

Principal Investigator:	Whelan, T.
Performing Organization:	Louisiana State University Systems, Center for Wetland Resources, University Station, Baton Rouge, LA 70803
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/HSE-1
Period:	10/76 - 9/77
Funds:	$10,197

Hydrocarbons, Groundwater, Sediments, Contamination, Oil fields, Biodegradation, Marshes

Dissolved organic compounds present in the interstitial waters of oil field sediments will be chemically classified, and the potential of using the amount of dissolved organic carbon in interstitial waters as an indicator of chronic petroleum contamination will be investigated.

Status: Preliminary analysis of aromatic and alkane hydrocarbons present in the tissues of organisms from two oil field environments is in progress.

[SSIE No. GBP-2529-1]

3. SOCIAL/ECONOMIC ASPECTS

[No entries.]

4. GENERAL ASPECTS

R-119-78

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO

Principal Investigator: Caillouet, C.W.
Performing Organization: US Dept. of Commerce, NOAA, 6010 Executive Blvd., Rockville, MD 20852
Supporting Agency: US Environmental Protection Agency, Office of Energy, Minerals & Industry, 401 M St. SW, Washington, D.C. 20460. Interagency No. D6-E693-EO, V625A-35
Period: 10/76 - 9/77
Funds: $665,000

Oil fields, Environmental effects, Ecosystems, Contaminants, Gulf of Mexico

This assessment of the 17-yr-old Buccaneer Oil and Gas Field was initiated in April 1976. Objectives are: 1) identification and documentation of the extent and types of biological, chemical, and physical effects resulting from development and production; 2) determination of the specific contaminants, their quantity, and effects on the ecosystem; and 3) development of methods for description and prediction of the fate and effects of oil field discharge constituents on the ecosystem.

Status: The second year of research investigated the environmental and ecosystem variables in the oil and gas field in order to compare production platforms that release brines and other effluents with satellite platforms (well jackets) that release no effluents.

[SSIE No. GMA-4680]

Reports and Publications

ICHTHYOPLANKTON OF THE BUCCANEER OIL FIELD OFF GALVESTON, TEXAS
Finucane, J.H., and L.A. Collins. 1977.
Biennial International Estuarine Research Conference, 4th, Mt. Pocono, Pennsylvania, 1977. Abstract.

A STUDY PLAN FOR THE BUCCANEER OIL FIELD ASSESSMENT PROGRAM
Gallaway, B.J., R. Howard, K. Green, and L. Martin. 1976.
Report to NMFS from LGL, Ltd.-U.S. Inc., Bryan, Texas. 69p.

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO, 1976-1977
Jackson, W.B. (ed.). 1977.
NOAA Annual Report to EPA, Project No. EPA-IAG-D6-E693-EO. 759p.

ENVIRONMENTAL ASSESSMENT OF THE BUCCANEER OIL AND GAS FIELD OFF GALVESTON, TEXAS: AN OVERVIEW
Jackson, W.B., K.N. Baxter, and C.W. Caillouet. 1978.
Offshore Technology Conference, 10th, Houston, Texas, 1978.
Vol. 1:277-284. (OTC 3081)

A PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE BUCCANEER OIL/GAS FIELD (PILOT STUDY OF THE BUCCANEER OIL FIELD, BENTHOS AND SEDIMENTS)
Harper, D.E., Jr., R.J. Scrudato, and C.S. Giam. 1976.
Final report to NMFS from Texas A&M University. Contract 03-6-42-35110. 63p.

ENVIRONMENTAL EFFECTS OF OFFSHORE OIL PRODUCTION: ALKANES IN THE REGION OF THE BUCCANEER OILFIELD
Middleditch, B.S., B. Basile, and E.S. Chang. 1977.
Journal of Chromatography Vol. 142:777-785.

[For summary see OPR 5(1):#C-0263-78.]

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO (A REPORT OF NMFS/LGL WORKSHOP I, 1977-1978)
National Marine Fisheries Service. 1977.
Report to NMFS from LGL, Ltd.-U.S. Inc., Bryan, Texas. Project No. EPA-IAG-D6-E693-EP.

ASSESSMENT OF ENVIRONMENTAL IMPACT OF OFFSHORE PRODUCTION IN THE BUCCANEER OIL FIELD: SEDIMENTOLOGIC AND GEOCHEMICAL RESULTS
Wheeler, R.B., R.R. Schwarzer, and J.B. Anderson. 1978.
Offshore Technology Conference, 10th, Houston, Texas, 1978.
Vol. 1:285-290. (OTC 3082)

Information Source: W.B. Jackson, US Dept. of Commerce, NOAA, NMFS, Galveston Laboratory, 4700 Ave. U, Galveston, TX 77550.

R-120-78
THE IMPACT OF THE OIL AND GAS INDUSTRY ON THE LOUISIANA COAST

Principal Investigator:	Davis, D.W.
Performing Organization:	Nicholls State University, Graduate School, Thibodaux, LA 70301
Supporting Agency:	US Dept. of the Interior, Geological Survey, Office of Land Information & Analysis, 12201 Sunrise Valley Dr., Reston, VA 22092
Period:	7/75 - 6/76

Oil industry, Coasts, Development, Louisiana

[Summary not available.]

[SSIE No. ZUA-4528]

R-121-78
ANALYSIS OF WATER RESOURCES REQUIREMENTS FOR THE ENHANCED (TERTIARY) OIL RECOVERY IN THE SOUTHERN PLAINS REGION OF THE UNITED STATES
Principal Investigator: Shih, C.S.
Performing Organization: University of Texas, Graduate School, 4242 Piedras Dr., Suite 250, San Antonio, TX 78284
Supporting Agency: US Dept. of the Interior, Office of Water Research & Technology, 19th & C Sts. NW, Washington, D.C. 20240. No. B-218-TEX
Period: 6/78 - 12/78
Funds $12,009

Resource management, Analytical techniques, Drilling, Contamination, Groundwater, Economic effects, *Enhanced oil recovery, *Water resources

Objectives for this project include: development of a quantitative analysis procedure integrated with petroleum technology forecasting, for the projection of water resource requirements to support future enhanced oil recovery operations in the Southern Plains Region; projection of the distribution of these operations and assessment of the economic trade-offs involved vs high quality water resources requirements; identification of potential pollution effects on surface and groundwater resources; and generalization of the developed analytical procedures for use in future analyses.

[SSIE No. GUY-1084-1]

5. BASELINE AND ENVIRONMENTAL IMPACT STUDIES

R-122-78 (R-064-77)
MITIGATION GOALS FOR OIL SHALE
Principal Investigator: Unknown
Performing Organization: Colorado State University, State Cooperative Wildlife Research Unit, Fort Collins, CO 80523
Supporting Agency: US Dept. of the Interior, Fish & Wildlife Service, Office of Biological Services, 19th & C Sts. NW, Washington, D.C. 20240. Contract WELUT No. 051-75
Period: 11/77 - 10/78

Baseline studies, Oil shale, Fish, Wildlife, Environmental effects, *Population reduction

"This study will identify the most significant fish and wildlife population reductions that will result from environmental changes caused by oil shale development, formulate a list of candidate mitigation goal alternatives, and evaluate the effectiveness of a sample of previous attempts to mitigate wildlife population reductions....No collection of quantitative data in the field is anticipated."

[SSIE No. GU-144-2]

R-123-78 (R-021-77)

ENVIRONMENTAL ASSESSMENT OF NORTHERN PUGET SOUND & THE STRAIT OF JUAN DE FUCA

Principal Investigator: Harris, H.S., E.R. Long, and R. Kopenski
Performing Organization: US Dept of Commerce, NOAA, Environmental Research Labs, MESA Puget Sound Project, 7600 Sand Point Way NE, Seattle, WA 98115
Supporting Agency: US Environmental Protection Agency, Office of Energy Minerals, & Industry, 401 M St. SW, Washington, D.C. 20460. Interagency No. D6-E693-EN, V625A-34
Period: 9/75 - 9/80
Funds: $963,000

Baseline studies, Environmental management, Development, Hydrocarbons, Marine organisms, Models, Puget Sound

This project is designed to provide the ecological data required for making management decisions concerning regional development and for assessing the potential impact of petroleum hydrocarbons on the ecosystem. Final products will include: 1) characterization of the major marine biological populations at risk from large oil spills; 2) description of the physical and chemical processes which transport hydrocarbons; 3) baseline of current existence and variability of hydrocarbons in the marine environment; and 4) state-of-the-art oil spill trajectory model for the title area.

[SSIE No. GMA-4683]

Reports and Publications

SURFACE DRIFTER MOVEMENTS OBSERVED IN OUTER STRAIT OF JUAN DE FUCA, JULY 1977
Ebbesmeyer, C.C., J.M. Helseth, and J.M. Cox. 1977.
NOAA Technical Memorandum ERL MESA-22. 22p.

THE INTERTIDAL AND SHALLOW SUBTIDAL BENTHOS OF THE STRAIT OF JUAN DE FUCA
Nyblade, C.F. 1978.
NOAA Technical Memorandum ERL MESA-26. 151p. (est.) Spring 1976-Winter 1977.

RECOMMENDATIONS FOR MICROBIOLOGICAL STUDIES IN THE CONTINENTAL SHELF AREAS
Outer Continental Shelf Environmental Assessment Program. 1977.
NOAA Technical Memorandum ERL MESA-16. 45p. Results from two workshops convened 10-11 August 1976 and 19-20 October 1976 in Boulder, Colorado.

Information Source: H.S. Harris, Manager, MESA Puget Sound Project, address above.

R-124-78

EARLY LIFE HISTORIES OF SPANISH AND KING MACKEREL IN GULF OF MEXICO

Principal Investigator: McEachran, J.D.
Performing Organization: Texas A&M University System, School of Agriculture, College Station, TX 77843
Supporting Agency: US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/F-2
Period: 10/76 - 9/77
Funds: $24,000

Fisheries, Baseline studies, Gulf of Mexico, *Mackerel

A baseline study of various aspects of Spanish and King mackerel in the Gulf of Mexico is being conducted to aid in the development of commercial and recreational fisheries. "Determination of the larval fishes that occupy the neuston layer will furnish data on the effects of an oil spill on the important fishery resources in the northern Gulf of Mexico."

[SSIE No. GBP-3010]

R-125-78

ECOLOGICAL EFFECTS OF OIL & DERIVED HYDROCARBONS & PRODUCE GUIDELINES FOR DAMAGE ASSESSMENT & METHODS FOR PREDICTING IMPACT

Principal Investigator: Swartz, R.
Performing Organization: US Environmental Protection Agency, Environmental Research Lab, 200 SW 35th St., Corvallis, OR 97330
Supporting Agency: Same as above. No. M608C-097
Period: 10/76 - 9/77
Funds: $49,400

OCS, Development, Marine organisms, Intertidal zone, Bioindicators, Environmental effects, Environmental protection, Guidelines, Alaska

The effects of oil spills on sub and intertidal benthic communities will be assessed by an intertidal sampling design. Indicator organisms will be identified, and assessment and criteria documents developed for use in environmental protection planning during OCS development in Alaska.

[SSIE No. ZMA-1379]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-126-78 (R-119-76)
CLEANUP OF OIL IN SOIL BY BIODEGRADATION
Principal Investigator: Unknown
Performing Organization: Sun Ventures, Inc.
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. OS-21 Series
Period: Unknown

Biodegradation, Monitoring, Fate, Toxicity, Soil

The project consists of monitoring the fate and effects of oil introduced into 42 plots located at Marcus Hook, Pennsylvania, Tulsa, Oklahoma, and Corpus Christi, Texas. Sampling is at six-month intervals. Oil concentration and changes in gross composition will be determined. Once during the year the plots will be seeded to determine phytotoxicity effects.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Status: A new contract has been initiated with Sun Ventures to continue similar work.

Reports and Publications

BACTERIAL GROWTH IN AND PENETRATION OF CONSOLIDATED AND UNCONSOLIDATED SANDS CONTAINING GASOLINE
Raymond, R.L, J.O. Hudson, and V.W. Jamison. n.d.
American Petroleum Institute Project 307-76.

OIL DEGRADATION IN SOIL
Raymond, R.L., J.O. Hudson, and V.W. Jamison. 1976.
Applied and Environmental Microbiology 31(4):522-535.

[For summary see OPR Aug 76-Oct 76:#C-2205-76.]

BENEFICIAL STIMULATION OF BACTERIAL ACTIVITY IN GROUNDWATERS CONTAINING PETROLEUM PRODUCTS
Raymond, R.L, V.W. Jamison, and J.O. Hudson. 1976.
AIChE Symposium Series 73(166):390-404.

Information Source: C.F. Frandsen, API, address above.

R-127-78 (R-104-76)

RESPONSE OF SELECTED MICROBIAL POPULATIONS IN A TIDAL MARSH TO CRUDE OIL

Principal Investigator: Unknown
Performing Organization: Virginia Institute of Marine Science, Gloucester Point, VA 23062
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 203-75
Period: 5/75 - 2/79

Biodegradation, Bacteria, Fungi, Crude oil, Marshes, Estuaries, Sediments

The research deals with measuring the effects of spilled crude oil upon natural tidal marsh microbial populations which use hydrocarbons. Field monitoring and laboratory studies are conducted on bacterial and fungal populations in water and sediments of salt marshes.

Status: Spilled oil has caused a large increase in hydrocarbon-oxidizing microbial populations and no decrease in cellulose or chitin decomposers. If present trends continue, stabilization of the microbial population may match that in the control areas.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

Reports and Publications

MICROBIAL RESPONSES AFTER TWO EXPERIMENTAL OIL SPILLS IN AN EASTERN COASTAL PLAIN ESTUARINE ECOSYSTEM
Kator, H., and R. Herwig. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Clean-up), New Orleans, March 8-10, 1977. p. 517-522. (American Petroleum Institute No. 4284)

[For summary see OPR Feb 77-Apr 77:#C-0786-77.]

Information Source: H.I. Kator, Virginia Institute of Marine Science, address above.

R-128-78 (R-059-74)

NAVY ENVIRONMENT: BIODEGRADATION OF OIL POLLUTANTS BY YEAST AND YEAST LIKE FUNGI

Principal Investigator: Ahearn, D.G., and W.L. Cook
Performing Organization: Georgia State University, School of Arts and Sciences, 33 Gilmer St., S.E., Atlanta, GA 30303
Supporting Agency: US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. Contract No. DN123203, N00014-71-C-0145

Period: 10/77 - 9/78
Funds: $18,000

Biodegradation, Yeasts, Fungi, Emulsification, Toxicity, Growth

To provide a bettter understanding of biodegradation in the marine environment and of its enhancement, the effects of oil soluble toxicants on growth and oil emulsification by yeasts are being studied. The factors necessary for optimum nutrient enrichment and oxygenation for oil degradation by yeasts are being determined. The assessment of possible toxicity of selected fungi to marine and estuarine organisms is being continued.

[SSIE No. GQN-123203-7]

[For Reports and Publications see OPR Feb-Apr 77 p. 241.]

R-129-78 (R-027-76)

NAVY ENVIRONMENT: FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD ENVIRONMENTS

Principal Investigator: Atlas, R.M.
Performing Organization: University of Louisville, School of Arts and Sciences, 129 E. Broadway, Louisville, KY 40208
Supporting Agency: US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. No. DN475257, Contract N00014-76-C-0400
Period: 10/77 - 9/78
Funds: $20,619

Biodegradation, Microorganisms, Biological effects, Coasts, Ice, Alaska

Summer field work concerned with monitoring changes in microbial populations of Alaskan coastal waters exposed to petroleum hydrocarbons is being conducted jointly with the Naval Arctic Research Laboratory. The effects of oil on essential microbial processes (nitrogen fixation and photosynthesis) are being studied. Experiments are being done to determine if oil is degradable when the sea is frozen.

[SSIE No. GQN-475257-4]

R-130-78 (R-120-76)

INTERACTIONS OF CHEMICAL POLLUTANTS AND MICROORGANISMS IN THE NEW JERSEY COASTAL ENVIRONMENT

Principal Investigator :	Bartha, R., and A.D. Antoine
Performong Organization:	Rutgers The State University, Agricultural Experiment Station, Old Queens Building, New Brunswick, NJ 08903
Supporting Agency:	US Dept. of Agriculture, Cooperative State Research Service, New Jersey, Washington, D.C. 20250. No. 0068007, NJ00507
Period:	10/77 - 9/78

Biodegradation, Contaminants, Biological effects, Microorganisms, Estuaries, Uptake, New Jersey, Food web

The interaction of chemical pollutants such as petroleum hydrocarbons, polychlorinated biphenyls, pesticide residues, heavy metals, and pollutants that give rise to eutrophication with estuarine microorganisms will be investigated. The action of pollutants on essential microbial processes (biodegradation, nitrification, etc.) and the concentration of pollutants in microorganisms and in higher members in estuarine food chains will be determined.

[SSIE No. GY-68007-2]

Status: Studies on the optimization of oil sludge biodegradation are concluded and publication material is now being prepared. A project on the long-term fate of PAHs in landfarming disposal of oil sludges has been initiated.

Reports and Publications

THE MICROBIOLOGY OF AQUATIC OIL SPILLS
Bartha, R., and R.M. Atlas. 1977.
Advances in Applied Microbiology. D. Perlman (ed.). New York, Academic Press, 1977. Vol. 22:225-265.

THE BIODEGRADATION OF OIL SLUDGE IN SOIL
Dibble, J.T., and R. Bartha. 1978.
American Society for Microbiology Annual Meeting, 78th, 1978. Paper No. Q71. Abstract.

Information Source: R. Bartha, address above.

R-131-78 (R-162-76)

NATURAL BIODEGRADATION OF OIL IN AQUEOUS ENVIRONMENTS

Principal Investigator:	Colwell, R.R.
Performing Organization:	University of Maryland, Dept. of Microbiology, College Park, MD 20742
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. OS-20I
Period:	Unknown

Biodegradation, Fate, Microorganisms, Crude oil

The project objectives were to determine the rate and mechanisms of degradation and ultimate fate of oil in the marine environment through the activity of naturally occurring microorganisms. Oil biodegradation products were identified by generic types and by the percentage of oil components that show resistance to microbial action.

Status: A second draft final report has been submitted to API. A separate Executive Summary will be issued by API covering those areas outlined in the original research proposal.

[from Environmental Research, Annual Status Report, Febuary 1978. API Publication No. 4293]

Reports and Publications

BEHAVIOR OF ^{14}C-LABELLED METHYL PALMITATE DURING ALUMINA CHROMATOGRAPHY OF PETROLEUM HYDROCARBONS
Wickramasinghe, R.H., A.L. Mills, and R.R. Colwell. 1977.
Naturwissenschaften Vol. 64:584.

BEHAVIOR OF C-14 LABELLED METHYL PALMITATE DURING CHROMATOGRAPHY OF PETROLEUM HYDROCARBONS ON THE SARA COLUMN
Wickramasinghe, R.H., A.L. Mills, R.R. Colwell, and C. Ponnamperuma. 1978.
Journal of Chromatography Vol. 147:419-420.

Information Source: R.R. Colwell, address above.

R-132-78 (R-339-74)

NAVY ENVIRONMENT: MICROBIAL DEGRADATION OF PETROLEUM IN THE MARINE ENVIRONMENT

Principal Investigator:	Colwell, R.R.
Performing Organization:	University of Maryland, School of Agriculture, College Park, MA 20742
Supporting Agency:	US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. Contract No. DN223667, N00014-75-C-0340
Period:	10/77 - 9/78
Funds:	$29,641

Biodegradation, Bacteria, Microorganisms, Analytical techniques, Chemical analysis

The ability of marine and estuarine bacteria to degrade hydrocarbons and petroleum *in situ* is being tested by a variety of techniques including electron microscopy and gas liquid chromatography. The biodegradation of lipids and refractory materials in suspended particulates is being examined. The interactions of microorganisms in estuarine and oceanic ecosystems are investigated.

[SSIE No. GQN-223667-4]

Reports and Publications

MICROBIAL DEGRADATION OF PETROLEUM IN THE MARINE ENVIRONMENT
Colwell, R.R. 1977.
Annual Report UM/ONR-4, Contract N00014-75-C-0340 P00003, Task NR 133-081. 21p. Annual Report submitted to Office of Naval Research, January 1, 1977-December 31, 1977.

MICROBIAL ECOLOGY STUDIES OF THE METULA SPILL IN THE STRAITS OF MAGELLAN
Colwell, R.R., A.L. Mills, J.D. Walker, P. Garcia-Tello, and V. Campos-P. 1978.
Journal of the Fisheries Research Board of Canada 35(5): 573-580.

(For summary see this issue OPR.]

ENUMERATION OF PETROLEUM-DEGRADING MARINE AND ESTUARINE MICROORGANISMS BY THE MOST PROBABLE NUMBER METHOD
Mills, A.L., C. Breuil, and R.R. Colwell. 1978.
Canadian Journal of Microbiology 24(5):552-557.

Information Source: R.R. Colwell, address above.

R-133-78

THE BACTERIAL FLORA IN SURFACE MICROLAYERS OF OCEAN AND ESTUARINE WATERS AND ITS ABILITY TO DEGRADE CRUDE OIL

Principal Investigator:	Oliver, J.D.
Performing Organization:	University of North Carolina, School of Science & Math, Highway 49 N, Charlotte, NC 28223
Supporting Agency:	American Chemical Society, 1155 16th St. NW, Washington, D.C. 20036. No. 10145-G2
Period:	10/77 - 9/78
Funds:	$3,000

Biodegradation, Bacteria, Crude oil, Sea surface, Sediments, Oceans, Estuaries, *Water column

This project proposes to "1) quantitatively and qualitatively examine the bacterial flora occurring in the upper 100 microns of selected estuarine and ocean waters, with comparisons to those found at a depth of one meter and in bottom sediments, and 2) study these populations' ability to degrade crude oil."

[SSIE No. PCS-2984]

R-134-78

MICROBIAL OIL DEGRADATION AT LOW TEMPERATURES IN TERRESTRIAL ENVIRONMENT

Principal Investigator:	Sparrow, E.B., C.V. Davenport, R.C. Gordon, and R. Jackson
Performing Organization:	US Environmental Protection Agency, Arctic Environmental Research Station, Fairbanks, AK 99701
Supporting Agency:	US Environmental Protection Agency, 401 M St. SW, Washington, D.C. 20460
Period:	7/77 - 6/78

Biodegradation, Crude oil, Microorganisms, Soil, Subarctic regions

The purpose of this research is "to establish the role of natural microbial populations in crude oil degradation and to assess the effects of hot crude oil on natural microbial populations."

[SSIE No. ZMA-1375]

Status: This project is part of a larger CRREL project on the "Effect of Oil on Permafrost Underlain Terrain" and will be completed by 12/31/78. Results of the three-year study will appear in the final report due in the Spring of 1979.

Reports and Publications

RESPONSE OF MICROORGANISMS TO HOT CRUDE OIL SPILLS IN A SUBARCTIC TAIGA SOIL
Author unknown. 1978?
Arctic. In press.

IMPACT OF HOT CRUDE OIL SPILLS ON MICROORGANISMS IN A TAIGA SOIL IN ALASKA
Sparrow, E.B., C.V. Davenport, and R.C. Gordon. 1978.
American Society for Microbiology, 78th Annual Meeting, Las Vegas, Nevada, 1978. R. Slepecky (ed.). Washington, D.C., American Society for Microbiology, 1978. p. 207. Abstracts.

Information Source: E. Sparrow and C. Davenport, US EPA, Arctic Environmental Research Laboratory, College, AK 99701.

2. PHYSICAL/CHEMICAL CHANGES

R-135-78
FATE OF OIL IN A WATER ENVIRONMENT: DILUTION STUDY OF A CONTROLLED OIL SPILL
Principal Investigator: Unknown
Performing Organization: JBF Scientific Corporation
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 201-75
Period: Unknown

Oil slicks, Dispersions, Behavior, Fate, Models

This project supplements a University of Southern California study (R.L. Kolpack) for development of an oil spill mathematical model. Oil spill tests at sea have been designed and conducted in order to obtain physical and chemical data on the dispersion of oil slicks by natural forces. Four controlled spills of Murban and La Rosa crude oils have been performed.

Status: The project has been completed and the final report has been issued as API Publication 4290, "Physical and Chemical Behavior of Crude Oil Slicks on the Ocean."

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-136-78 (R-009-77)
SOLUBILIZATION AND BIODEGRADATION OF HYDROCARBONS
Principal Investigator: Barnett, S.M, C.W. Houston, and A.R. Thompson
Performing Organization: University of Rhode Island, School of Engineering, Administration Bldg., Wakefield, RI 02881
Supporting Agency: US Dept. of the Interior, Office of Water Research & Technology, 19th & C Sts. NW, Washington, D.C. 20240. No. B-073-RI
Period: 7/77 - 6/78

Surfactants, Biodegradation, Wastewater treatment, Spill cleanup, *Solubilization

The proposed study will concentrate on the transport of hydrocarbons through the aqueous media, which is believed to be the rate controlling factor in the treatment of hydrocarbons. The investigators will identify surfactant characteristics which promote hydrocarbon solubilization, transport and biodegradation, and suggest surfactants for use in waste treatment plants and in natural environments.

[SSIE No. GUY-523-1]

R-137-78

THE EFFECTS OF OIL COMPOSITION AND PHYSICAL PROPERTIES AND THE AMBIENT WATER ON OIL SLICK DISPERSION

Principal Investigator:	Donnelly, R.G.
Performing Organization:	Massachusetts Institute of Technology, School of Engineering, 77 Massachusetts Ave, Cambridge, MA 02139
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/M-2
Period:	10/76 - 9/77
Funds:	$23,100

Oil slicks, Dispersions, Models, Chemical effects, Physical effects, Emulsions, *Wave action

Specific objectives of the first year's research are to: 1) "Determine the role of the formation of relatively stable oil/water emulsions as a dispersion mechanism as a function of the physical, chemical and colloidal properties of the oil and ambient water (the system)"; 2) Design and conduct small-scale simulated wave and slick experiments; 3) Assess wave action inducement of stable oil/water emulsion formation for several natural oils; and 4) Develop a synthetic oil for future experiments.

[SSIE No. GBP-2878]

R-138-78 (R-026-77)

OIL SLICK CONTROL IN OFFSHORE ENVIRONMENTS

Principal Investigator:	Milgram, J.H.
Performing Organization:	Massachusetts Institute of Technology, School of Engineering, 77 Massachusetts Ave., Cambridge, MA 02139
Supporting Agency:	US Dept. of Commerce, NOAA, Sea Grant Office, Washington, D.C. 20235. No. R/M-1
Period:	10/76 - 9/77
Funds:	$33,900

Oil slicks, Spreading, Fate, Models, Spill cleanup

Project objectives are: 1) to develop an analytical theory for the spreading of oil slicks under the combined influences of gravity and surface tension and 2) to conduct laboratory experiments on the same. Resulting information will be useful for development of spill cleanup plans and for determination of oil spill trajectories for impact assessment. Recent analysis has focussed on restrained slick geometry.

[SSIE No. GBP-2379-1]

R-139-78

NAVY ENVIRONMENT: CHEMISTRY OF DISSOLVED ORGANIC MATTER AND ITS INTERACTION WITH TRANSITION METALS IN SEAWATER

Principal Investigator: Quinn, J.G., and D.R. Kester

Performing Organization: University of Rhode Island, Narragansett Marine Laboratory, Narragansett Bay Campus, Wakefield, RI 02882

Supporting Agency: US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. Contract DN675078, N00014-76-C-0226

Period: 10/77 - 9/78

Funds: $45,293

Hydrocarbons, Solubility, Seawater, Chemical effects, USN

This research proposes to elucidate the role of dissolved organic matter in seawater (including the solubilization of hydrocarbons) in the chemical phenomena related to Naval operational problems (sound propagation, corrosion, dsl, ocean floor stability, and underwater visibility).

[SSIE No. GQN-675078-1]

3. GENERAL FATE

R-140-78

DISTRIBUTION AND FATE OF BIOGENIC AND PETROLEUM-DERIVED SUBSTANCES IN MARINE SEDIMENTS

Principal Investigator: Kaplan, I.R., W.E. Reed, T. Ronan, B. Simoneit, et al.

Performing Organization: University of California, Inst. of Geophysics & Planetary Physics, 405 Hilgard Ave., Los Angeles, CA 90024

Supporting Agency: US Energy Research & Development Administration, Div. of Biomedical & Environmental Research, 1717 H St. NW, Washington, D.C. 20545. Contract EY-76-S-03-0034

Period: 10/76 - 9/77

Funds: $101,351

Fate, Distribution, Biogenic hydrocarbons, Petrochemicals, Sedimentation, Oceans

Project studies include: evaluation of marine and terrestrial contributions of carbon compounds to ocean sediments; fluxes of carbon, nitrogen, phosphorus, and sulfur at the sediment-water interface; differentiation of marine biogenic and petrochemical hydrocarbons; and fate of hydrocarbons in the sediment column. Offshore oils and beach tars have been characterized by using stable isotopes of carbon, nitrogen, and sulfur as tracers.

[SSIE No. GPE-6130]

Reports and Publications

ORGANIC GEOCHEMISTRY OF RECENT SEDIMENTS FROM GUAYMAS BASIN, GULF OF CALIFORNIA
Simoneit, B.R.T., M.A. Mazurek, S. Brenner, P.T. Crisp, and I.R. Kaplan. n.d.
Deep-Sea Research. (Submitted.)

Information Source: I.R. Kaplan, address above.

R-141-78

ENVIRONMENTAL ASSESSMENT OF TREATED OIL SPILLS VERSUS UNTREATED SPILLS

Principal Investigator: Wilson, M.P., R.B. Dowdell, C. Brown, R. Traxler, et al.
Performing Organization: University of Rhode Island, School of Engineering, Administration Bldg, Wakefield, RI 02881
Supporting Agency: US Energy Research & Development Administration, Div. of Biomedical & Environmental Research, 1717 H St. NW, Washington, D.C. 20545. Contract EY-76-S-02-4047
Period: 7/77 - 6/78
Funds: $400,000

Fate, Models, Oil spills, Dispersants, Biodegradation, Weathering, Evaporation, *Prediction

"Phase II and III of these studies consists of meso-scale and *in situ* tests to determine the fate of an oil spill that has been treated with a dispersant and compare these results with the untreated oil spill." Weathering and biodegradation alterations of the spill are integrated into a fate model for assessment and prediction of the environmental impact.

Status: Feasibility tests and predictive models have been confirmed by results obtained.

[SSIE No. GPE-6147]

R-142-78 (R-003-78)

NAVY ENVIRONMENT: CHARACTERISTICS AND STABILITY OF COLLOIDAL MATERIAL ACCOMMODATING HYDROCARBONS IN THE OPEN OCEAN

Principal Investigator:	Zsolnay, A.
Performing Organization:	Duke University, Graduate School, Durham, NC 27706
Supporting Agency:	US Dept. of Defense, Navy, Office of Naval Research, 800 N. Quincy St., Arlington, VA 22217. No. DN675124, Contract N00014-76-C-1050
Period:	10/77 - 9/78
Funds:	$49,215

Hydrocarbons, Seawater, Benthos, Sediments, Chemical analysis, Fate, Sargasso Sea, *Transport

This project will study the contributions of organic compounds to characterizing the chemical and biological properties of seawater, their role as an energy source for the benthic community, and their effect on sediment physiochemical properties. The mechanism of transport of this material is emphasized. Seawater samples will be collected from the Sargasso Sea for fractionation of colloids and subsequent removal and chemical analysis of sorbed hydrocarbons.

[SSIE No. GQN-675124-1]

[for Reports and Publications see OPR 5(1):#R-003-78.]

4. MODELS AND PREDICTION

R-143-78

OCEAN OIL SPILL CONCENTRATION AND TRAJECTORY FORECAST

Principal Investigator:	Barrientos, C.S., K.W. Hess, L. Burroughs, and A.D. Taylor
Performing Organization:	US Dept. of Commerce, NOAA, 6010 Executive Blvd, Rockville, MD 20852
Supporting Agency:	US Environmental Protection Agency, Office of Energy, Minerals & Industry, 401 M St. SW, Washington, D.C. 20460. Interagency No. D5-E693-DY, V625C-10
Period:	10/76 - 9/77
Funds:	$170,000

Models, Oil spills, Coasts, Fate, NOAA, *Spill trajectory

An oil spill trajectory model will be developed and used to implement the model in the National Weather Service, NOAA. The model will be used operationally during oil spill episodes, and with climatological data for coastal impact assessment.

Status: The research program is divided as follows: 1) Weathering, 2) Spreading, 3) Diffusion, 4) Transport, and 5) Model Integration. Six contracts have been awarded, with 2 completed, and 1 renewed. The programming of a spreading diffusion model is complete, and oil spill data from such events as the Argo Merchant spill are being used to derive model parameters. A progress report was scheduled for submittal in September 1978.

[SSIE No. GMA-4651]

R-144-78

OIL SPILL VULNERABILITY OF THE COAST OF KODIAK ISLAND, ALASKA

Principal Investigator:	Hayes, M.O.
Performing Organization:	University of South Carolina, Geology Dept., Columbia, SC 29208
Supporting Agency:	NOAA-OCSEAP, Juneau, AK
Period:	10/77 - 10/78

Oil spills, Coasts, Environmental effects, Alaska, *Vulnerability, *Kodiak Island

"The purpose of this study is to evaluate present rates of change in coastal morphology with particular emphasis on rates and patterns of man-induced changes, to locate areas where coastal morphology is likely to be changed by man's activities, and to evaluate the effect of these changes. The relative vulnerability of different coastal areas to potential oil spills will be determined."

Information Source: E.R. Gundlach, Coastal Research Division, Dept. of Geology, University of South Carolina, Columbia, SC 29208.

R-145-78 (R-121-76)

FATE OF OIL IN A WATER ENVIRONMENT: MATERIAL BALANCE OF AN OIL SPILL

Principal Investigator:	Kolpack, R.L.
Performing Organization:	University of Southern California, Dept. of Environmental Geology, Los Angeles, CA 90007
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept, 2101 L St. NW, Washington, D.C. 20037. No. OS-20F
Period:	1/75 - 6/78 (est.)

Models, Marine organisms, Hydrocarbons, Oil slicks, Fate, Biodegradation

The project objective was to develop a computerized model capable of describing and perhaps predicting the exposure of marine animals to major hydrocarbon fractions found in an oil spill, and to describe the movement and degradation of an oil slick.

Status: A report documenting the computer simulation model and the draft final report have been submitted. A supplementary project, "Validation of Mathematical Model from Field Data," has been initiated.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-146-78

FATE OF OIL IN A WATER ENVIRONMENT: VALIDATION OF MATHEMATICAL MODEL FROM FIELD DATA GENERATED BY JBF SCIENTIFIC CORPORATION

Principal Investigator:	Kolpack, R.L.
Performing Organization:	University of Southern California, Dept. of Environmental Geology, Los Angeles, CA 90007
Supporting Agency:	American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 201-75
Period:	Unknown

Models, Oil spills, Fate, Behavior, *Predictions

This project proposes to test and validate an oil spill mathematical model developed by the University of Southern California (R.L. Kolpack). Field data collected by the JBF Scientific Corporation will be compared with results predicted by the model.

[from Environmental Research, Annual Status Report. Febuary 1978. API Publication No. 4293]

F. OIL POLLUTION REGULATIONS

[No entries.]

G. BIBLIOGRAPHIES

[No entries.]

H. MISCELLANEOUS

R-147-78
ENVIRONMENTAL PERSPECTIVES
Principal Investigator: Unknown
Performing Organization: Unknown
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 510-77
Period: ? - 12/78

Water quality, Oil industry, Pollution control, Statistical analysis, EPA, API

The project objective is "to monitor and critique the work being carried out by EPA's Criteria and Standards and Data and Monitoring Support Divisions as it relates to the petroleum industry."

Status: No report is planned.

Information Source: C.F. Frandsen, API, address above.

R-148-78
COST OF ENVIRONMENTAL REGULATIONS TO THE US PETROLEUM INDUSTRY
Principal Investigator: Unknown
Performing Organization: Battelle Columbus Laboratories
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 602-77
Period: Unknown

Cost analysis, Environmental protection, Regulations, API

Through this contract API is kept up to date on the cost of evolving EPA, state, and regional environmental regulations. Quantification of the secondary effects of such expenditures is being attempted currently.
[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

R-149-78

ANALYSIS OF EPA REFINERY SURVEY QUESTIONNAIRE

Principal Investigator: Unknown
Performing Organization: Brown & Root, Inc.
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 509-78
Period: ? - 12/78

Models, Guidelines, Statistical analysis, Refineries, Wastewaters, Cost analysis, EPA, API

The research purpose is "to develop an effluent flow model and to integrate this information with effluent concentrations and variability from the W-22 Task Force and other sources in order to determine whether EPA proposed guidelines are technically reasonable and cost-effective."

Status: No report is planned.

Information Source: C.F. Frandsen, API, address above.

R-150-78

ENVIRONMENTAL EXPENDITURE SURVEY

Principal Investigator: Unknown
Performing Organization: Haskins & Sells
Supporting Agency: American Petroleum Institute, Environmental Affairs Dept., 2101 L St. NW, Washington, D.C. 20037. No. 601-77
Period: 1966 - continuing

Cost analysis, Environmental protection, API

This continuing project annually surveys the environmental protection expenditures of the petroleum industry. API Publication No. 4287 reported the 1976 data, and the 1977 data will be published in September 1978.

[from Environmental Research, Annual Status Report, February 1978. API Publication No. 4293]

SECTION III: CURRENT CONFERENCES

* Additional information not available at time of publication
**Possibly oil pollution related topic or paper
FFI: For further information

AUG 22-23 Energy/Environment '78, Los Angeles, 1978
Sponsored by the Society of Petroleum Industry Biologists

Oil Pollution Related Papers

Session I. Baseline Studies: Where do we go from here?

THE OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDIES PROGRAM--OBSERVATIONS AND RECOMMENDATIONS
Hay, K.G.

BLM'S ENVIRONMENTAL STUDIES ON THE PACIFIC OCS
Keene, D.

CULTURAL RESOURCES ON THE SOUTHERN CALIFORNIA COAST, ISLANDS, AND CONTINENTAL SHELF: A BASELINE STUDY PROVIDES DATA PERTINENT TO FUTURE OIL AND GAS EXPLORATION
Stickel, E.G.

WASHINGTON BASELINE STUDY PROGRAM
Gardner, F.

ECOLOGICAL CHARACTERIZATION OF COASTAL ECOSYSTEMS OF THE UNITED STATES AND ITS TERRITORIES
Watson, J.F.

A METHODOLOGY TO AID SYNTHESIS OF INFORMATION FROM MULTIDISCIPLINARY ECOLOGICAL FIELD STUDIES ON PETROLEUM FATE AND EFFECTS
Appan, S.G., and I.A. Miller

**ECOSYSTEM PROCESS ANALYSIS: A NEW APPROACH TO IMPACT ASSESSMENT
Truett, J.C.

Session II. Impacts of Energy Development: Coal Mines and Oil Platforms

ECOLOGICAL IMPACT OF EXPLORATORY DRILLING: A CASE STUDY
Gettleson, D.A.

COMPARISONS OF FOULING COMMUNITY BIOMASS ON OFFSHORE OIL FIELD STRUCTURES IN THE GULF OF MEXICO WITH EMPHASIS ON APPARENT EFFECTS OF PRODUCED WATER DISCHARGE
Galloway, B.J., L.R. Martin, R. Howard, and M.F. Johnson

THE POTENTIAL FOR BIOLOGICAL CONTROL OF MARINE FOULING ON OFFSHORE OIL PLATFORMS: I. VERTICAL MIGRATION OF STARFISH FOLLOWING REMOVAL OF ANEMONES, A NATURAL BARRIER
Wolfson, A., N. Davis, G.S. Lewbel, L.L. Palmer, B. Evans, and A. McMullen

CHEMICAL STUDIES OF OFFSHORE OIL PLATFORMS IN THE SANTA BARBARA CHANNEL
McDermott-Ehrlich, D., D.R. Young, G.V. Alexander, T.-K. Jan, and G.P. Hershelman

Session III. Impacts of Energy Development: Barges, Pipelines, and Power Plants

**NEARSHORE STUDIES AT PRUDHOE BAY, ALASKA
Firth, R.W., Jr., and C.P. Falls

**EFFECTS OF A DOCK ON MARINE BENTHIC ORGANISMS AT PRUDHOE BAY, ALASKA
Robilliard, G.A., R.W. Firth, Jr., and D.W. Chamberlain

THE ENVIRONMENTAL IMPACT OF DISCHARGING DRILLING FLUIDS, COOK INLET, ALASKA
Charlton, D., C.P. Falls, R.C. Miller, J.P. Houghton, and D.L. Beyer

THE SHETLAND SCENE: LANDWARD ASPECTS OF OIL EXPLORATION AND DEVELOPMENT IN THE NORTHERN NORTH SEA
Syratt, W.J.

Session IV. Energy Development and Public Policy

ALASKAN OIL: A CASE HISTORY OF CONFUSION
Bright, D.B.

PUBLIC POLICY REGARDING HAZARDOUS MATERIALS
Tips, D.S.

Session V. Oil Spills: Fate and Effects

OUTER CONTINENTAL SHELF OIL SPILL IMPACT ON SOUTHERN CALIFORNIA RESOURCES
Cooke, T.S.

**NOAA SURFACE MAPPING RADAR: THEORY AND APPLICATIONS
Evans, M., and S. Frisch

BIODEGRADATION OF SUBMERGED CRUDE OIL USING THE HYDROLAB HABITAT
Scanland, T.B.

CHARACTERIZATION OF OILS AND SEEPS BY STABLE ISOTOPE RATIOS
Sweeney, R.E., and I.R. Kaplan

THE SIGNIFICANCE OF THE SANSINENA INCIDENT
Soule, D.F., M. Oguri, J.K. Dawson, R. Osborn, et al.

DETECTION OF EGGS FROM OIL-FED BIRDS BY ULTRAVIOLET FLUORESCENCE OF YOLK EXTRACTS
Grau, C.R., T.A. Wootton, T.E. Roudybush, W.N. Holmes, J. Cronshaw, and D.G. Ainley

THE EFFECTS OF INGESTED PETROLEUM ON LAYING IN MALLARD DUCKS (ANAS PLATYRHYNCHOS)
Holmes, W.N., J. Cronshaw, and K.P. Cavanaugh

Session VI. Oil Spills: Minimizing their Environmental Impact

EFFECTIVENESS OF OIL SPILL RESPONSES IN SAN FRANCISCO BAY
Burger, K.R., and W.R. Macke

THE ROLE OF THE U.S. FISH AND WILDLIFE SERVICE IN RESPONDING TO OIL SPILLS
Brown, C.H.

[Individual papers will be abstracted in OPR 5(4)]

Proceedings of the Conference are available for $10.00 from the Society of Petroleum Industry Biologists, c/o Dr. June Lindstedt Siva, Atlantic Richfield Company, 515 South Flower Street, Los Angeles, CA 90071

AUG 28-31 Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., 1978
Sponsored by the Canadian Aeronautics and Space Institute

Oil Pollution Related Papers

Poster Session II: Radar

DETECTION AND MONITORING OF OIL POLLUTION IN THE ICE ENVIRONMENT THROUGH MICROWAVE TECHNIQUES
Parashar, S.K., B. Dowe, and R.D. Worsfold

Session 3. Environmental Studies I

ENVIRONMENTAL MONITORING OF THE ATHABASCA OIL SANDS REGION
Ross, G.

Session 4. Environmental Studies II

**APPLICATION OF LANDSAT DATA IN THE STUDY OF OCEANOGRAPHICAL ENVIRONMENT
Ochiai, H., K. Takeda, and K. Tsuchiya

Session 5. Radar/Active System I

**THE LASER FLUOROSENSOR FOR MARINE POLLUTION MONITORING
Davies, J.H., G. Dick, and J. Keightley

FFI contact P.A. Cobbett, Executive Secretary, CASI, 75 Sparks St., Suite 60, Ottawa, Ontario KIP 5A5, Canada

AUG 28 - SEPT 1 *16th International Conference on Coastal Engineering, Hamburg, FRG, 1978
Sponsored by the American Society of Civil Engineering

FFI contact the German Convention Service, Hohe Bleichen 13, D-2000 Hamburg 36, FRG; or Secretary, Coastal Engineering Research Council, 412 O'Brien Hall, University of California, Berkeley, CA 94720

SEPT 6 *Microbial Corrosion Sulphate Reducing Bacteria in the Petroleum Industry, London, 1978
Sponsored by the Institute of Petroleum

FFI contact Ms. L. Boothby, Conference Officer, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, England

SEPT 6-8 Mid-Continent Conference and Exhibition on Control of Chemical and Oil Spills, Detroit, Michigan, 1978
Sponsored by US Environmental Protection Agency, Hazardous Materials Control Research Institute, International Association of Fire Chiefs, Information Transfer Inc., and States of Michigan, Minnesota, Indiana, Illinois, and Wisconsin

Oil Pollution Related Topics:

Session I: Impact of New US EPA and US Coast Guard Regulations

Session II: Real Time Aids for Spill Identification and Response

Session III: State Resources and Needs

Session IV/V: Case Histories

Session VI: Emergency Evacuations

Session VII: Training Programs

FFI contact Bobbie Zucker, Conference Coordinator, Information Transfer Inc., 1160 Rockville Pike, Suite 202, Rockville, MD 20852

SEPT 6-8 Oceans '78, Washington, DC, 1978
Sponsored by the Marine Technology Society, and the Institute of Electrical and Electronics Engineers' Council on Oceanic Engineering

Oil Pollution Related Papers

Session 20. Marine Pollution Analysis and Monitoring

ADVANCEMENTS IN OIL SPILL TRAJECTORY MODELLING
Garver, D.R., and G.N. Williams

**AN OBJECTIVE PROCEDURE FOR EVALUATING POLLUTANT DISPERSION AND FLUSHING IN TIDAL CANALS AND OPTIMIZING CANAL SYSTEM DESIGN
Morris, F.W.

**MARINE POLLUTION IN KUWAIT
Oostdam, B.L.

FFI contact Technical Programs Chairman, OCEANS '78, Suite 412,
1730 M Street NW, Washington, DC 20036

SEPT 10- SEPT 16 *International Congress of Ecology, Jerusalem, Israel, 1978
Sponsored by the International Association for Ecology, the International Union of Biological Sciences, the National Council for Research and Development, and the Environmental Protection Service

**Topics include ecological effects of development projects, ecological monitoring, coastal zone ecology and management, and others.

FFI contact Professor D. Amiran, Department of Geography, Hebrew University of Jerusalem, Jerusalem, Israel

SEPT 12- SEPT 15 *International Symposium on Biological Indicators of Water Quality, Newcastle-upon-Tyne, UK, 1978

FFI contact Biological Indicators Symposium, Department of Civil Engineering, The University, Newcastle-upon-Tyne NE1 7RU, UK

SEPT 14- SEPT 15 Third Inland Spills Conference, Cincinnati, Ohio, 1978
Sponsored by the Ohio Environmental Protection Agency

Papers focus on the following topics:

1) Underground hydrocarbon leaks;
2) Toxicities of hazardous materials;
3) Current spilled waste disposal options;
4) Role definitions: who does what on spills?;
5) Training programs;
6) Case histories of spills;
7) Ambient airborne spills of toxic substances; and
8) Confined space spill handling.

FFI contact William Bunner, Ohio EPA, Training and Safety Section,
361 E. Broad Street, Room 219, Columbus, OH 43215

SEPT 25- *Fifth International Ocean Development Conference and Exposition,
SEPT 29 Tokyo, Japan, 1978.

FFI contact Oil Industry International and Production Forum,
37 Duke Street, St. James's, London SW1Y 6OH, England

SEPT 28- Meeting on Monitoring the Marine Environment, London, 1978
SEPT 29 Sponsored by the Institute of Biology

Topics include monitoring in the littoral zone, below the littoral zone, and the open ocean; and biological implications of human activity as this affects the marine environment.

FFI contact D.J.B. Copp, General Secretary, 41 Queen's Gate,
London, SW7, England

OCT 1-6 51st Annual Water Pollution Control Federation Conference, Anaheim, California, 1978
Sponsored by the Water Pollution Control Federation

Oil Pollution Related Papers

Session 6: Industrial Wastes Symposium Case Histories
Risk Management of Toxics

DEVELOPMENT OF CRITERIA AND STANDARDS FOR TOXIC AND HAZARDOUS SUBSTANCES
Mackenthun, K.M.

**IMPLICATIONS OF TOXIC SUBSTANCES IN THE ESTABLISHMENT OF WATER QUALITY CRITERIA
Giavannitti, E., M.D. LaGrega, and M.L. Goldman

Session 17: Industrial Waste Symposium - Powdered Activated Carbon

POWDERED CARBON ENHANCEMENT VERSUS GRANULAR CARBON ADSORPTION FOR OIL REFINERY BATEA WASTEWATER TREATMENT
Grieves, C.G., L.W. Crame, D.G. Venardos, and W-C. Ying

Session 40: Toxic Materials

**A BIO-ASSAY TECHNIQUE FOR RELATIVE TOXICITY IN WATER POLLUTION CONTROL
Busch, A.W.

**DEVELOPMENT OF A SYSTEM TO PROTECT GROUNDWATERS THREATENED BY HAZARDOUS MATERIALS SPILLS
Huibregtse, K.R., J. Lafornata, and K.H. Kastman

FFI contact Water Pollution Control Federation, 2626 Pennsylvania
Ave. NW, Washington, DC 20037

OCT 4-6 *German Society for Petroleum Science and Coal Chemistry Annual Meeting, Berlin, Federal Republic of Germany, 1978
Sponsored by the German Society for Petroleum Science and Coal Chemistry

Topics include production, storage, transportation and distribution of crude petroleum products, and water pollution.

FFI contact German Society for Petroleum Science and Coal Chemistry, Hamburg 1, Nordkanalstr. 28/30, Federal Republic of Germany

OCT 16- OCT 17 Air and Water Pollution Control: Progress and Problems, Washington, DC, 1978
Sponsored by the Environmental Law Institute

**Conference topics

Clean Air and Water Versus Economic Development
Implementing the 1977 Amendments: New Standards, New Goals

Energy and Pollution Control Trade-Offs

Toward a Safe Environment: Increasing Regulations of Toxic and Hazardous Pollutants

Federal Initiatives, State and Local Responses

Enforcement: New Tools, New Deadlines

Recent and Pending Litigation

FFI contact Air and Water Pollution Control: Progress and Problems, Environmental Law Institute, 1346 Connecticut Avenue NW, Suite 600, Washington, DC 20036.

OCT 16- OCT 18 *Third International Conference on Waste Oil Recovery and Reuse, Houston, Texas, 1978
Sponsored by the Association of Petroleum Re-Refiners

FFI contact the Association of Petroleum Re-Refiners, 1730 Pennsylvania Ave NW, Washington, DC 20016

OCT 18- OCT 19 *Measurement and Control of Offshore Platforms and Land Terminals, Edinburgh, UK, 1978
Sponsored by the Institute of Measurement and Control

Topics include blowout protection instrumentation, monitoring of drill ships, and remote control systems.

FFI contact M.S. James, 6 Anne Mount, 44 Madeley Road, London W5, England

OCT 22- OCT 25 Seventh Annual Meeting on the Practice of Chromatography
Atlanta, Georgia, 1978
Sponsored by Committee E-19, American Society for Testing and Materials

Oil Pollution Related Papers

Session: Topical Discussion Groups

APPLICATION OF GC-MS TO ENVIRONMENTAL PROBLEMS
McGuire, J.

Session 6: How to Analyze for Trace Organics in Aqueous Systems

**DESIGN OF THE ORGANICS ANALYSIS IN AN ENVIRONMENTAL MONITORING SYSTEM
Buddle, W.

APPLICATIONS OF HIGH RESOLUTION CHROMATOGRAPHY/MASS SPECTROMETRY TO CHARACTERIZE ENVIRONMENTAL POLLUTANTS
Laseter, J.

FFI contact R.M. Sherwood, ASTM, 1916 Race Street, Philadelphia, PA 19103

OCT 24- OCT 27 *SPE European Offshore Petroleum Conference and Exhibition, London, UK, 1978
Sponsored by the Society of Petroleum Engineers, the Institute of Petroleum, the Institute of Mechanical Engineers, the Institute of Electrical Engineers

Topics include environmental issues of North Sea exploration, drilling, production, and transportation technology for oil

FFI contact SPE European Offshore Petroleum Conference and Exhibition, 6200 North Central Expressway, Dallas, TX 75206, or Ms. L. Boothby, Institute of Petroleum, 61 New Cavendish Street, London W1, England.

OCT 25- OCT 27 *Southern Spill Conference, Lake Buena Vista, Florida, 1978

FFI contact Floyd T. Syrcle, Jr. Belcher Oil Company, P.O. Box 011751, Miami, FL 33101

NOV 1-2 Spill Control Technology Seminar, Long Beach, California, 1978
Sponsored by the Spill Control Association of America

Papers focus on the following topics:

1) Current federal and state regulations, including enforcement procedures and disposal requirements;
2) Implications of the recently promulgated hazardous materials regulations;
3) Practical training and prevention methods;
4) Special problems relating to inland and harbor spills with emphasis on disposal of recovered material;
5) Equipment and measures to take before expert help arrives; and
6) Role of the spill contractor.

FFI contact Marc C. Shaye, SCAA, 17117 West Nine Mile Road, Suite 1515, Southfield, MI 48075

NOV 5-9 Energy Technology Conference and Exhibition, Houston, Texas, 1978
Sponsored by the American Society of Mechanical Engineers, and the National Association of Corrosion Engineers

Oil Pollution Related Topics

Session 22: Conservation of Water Products and Energy

*REUSE OF REFINERY EFFLUENT WATER
Green, R.P.

Session 63/67: Standards for Safety and Pollution Prevention Equipment Used in Offshore Oil and Gas Operations (Panel)

FFI contact Paul Drummond, Executive Secretary, Petroleum Division, American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

NOV 6-7 Symposium on Disposal of Oil and Related Materials and Debris Resulting from a Spill Clean-up Operation, Denver, Colorado, 1978
Sponsored by Committee F-20 on Spill Control Systems, American Society for Testing and Materials

Oil Pollution Related Papers

RECOMMENDATIONS FOR DISPOSAL OF OIL SPILL CLEAN-UP DEBRIS
Farlow, J.

UNITED STATES COAST GUARD SPONSORED FEASIBILITY STUDY OF DISPOSAL SYSTEMS FOR OIL RECOVERED FROM MARINE SPILLS - A PROGRESS REPORT
Hansen, W., J.R. Sinclair, and D.E. Ross

DISPOSAL OF OILY WASTE FROM OIL SPILLS BY LAND FARMING
Wahbeh, W.

SANITARY LAND FILL RECLAMATION
Thompson, S.

EXISTING STATE LEGISLATION, AS IT AFFECTS THE REMOVAL OF OILY WASTES FROM COASTAL AREAS
Matthews, T.G.

OIL SPILL DEBRIS DISPOSAL IN MAINE
Aho, H., and M. Guerin

EMERGENCY OIL AND RELATED MATERIALS EMERGENCY DISPOSAL IN NORTHERN AND CENTRAL CALIFORNIA
Caron, D.D.

OIL SPILL LANDFILL SITES ALONG THE BEAUFORT SEA COAST
Blackhall, P.J., and W. Robson

STORAGE AND DISPOSAL OF OILY WASTES IN ALASKA
Jeane, S.O.

PRACTICAL EXPERIENCES OF THE HANDLING AND DISPOSAL OF WATER-IN-OIL EMULSIONS
Westaway, M.T., and P.D. Holmes

API ENVIRONMENTAL AFFAIRS RESEARCH IN OILY SOLID WASTE
Knowlton, H.E., and J. E. Rucker

DESIGN OF A MOBILE INCINERATION SYSTEM FOR RESIDUALS FROM OIL AND HAZARDOUS MATERIAL SPILL
Brugger, J.E., and F.J. Freestone

FFI contact Mr. Sam Bowman, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

NOV 7-10 National Symposium on Wetlands, Lake Buena Vista, Florida, 1978
Sponsored by the American Water Resource Association

Oil Pollution Related Papers

The Value of Wetlands-II -- Session 4

WATER QUALITY
Cairns, J., Jr.

FFI contact Dr. Phillip E. Greeson, US Geological Survey, National Center, MS 412, Reston, VA 22092

NOV 12- NOV 16 American Institute of Chemical Engineers 71st Annual Meeting, Miami Beach, Florida, 1978
Sponsored by the American Institute of Chemical Engineers

Oil Pollution Related Papers

Session 40: Environmental Assessment of Solid Fossil Fuel Processes Part II

Paper 40a
DEPARTMENT OF ENERGY ENVIRONMENTAL PLANNING PROCESS RELATED TO OIL SHALE TECHNOLOGY
Thomas, H.E., R. Franklin, and J. Powderly

Paper 40b
RESULTS OF EPA'S PRELIMINARY ENVIRONMENTAL ASSESSMENT AT THE PARAHO OIL SHALE DEMONSTRATION RETORT
Pressey, R.E., C.H. Habenicht, and C.H. Prien

Paper 40c
SPENT SHALE DISPOSAL R&D: EPA'S EFFORTS
Bates, E.R., E.F. Harris, and T. Thoem

Paper 40d
WATER RELATED ENVIRONMENTAL EFFECTS IN FUEL CONVERSION
Gold, H., J.A. Nardella, and C.A. Vogel

Paper 40e
ENVIRONMENTAL ASSESSMENT OF TAR SANDS PROCESSING OPERATIONS
Kerr, R.D.

Paper 40f
**ENVIRONMENTAL ASSESSMENT OF WASTE-TO-ENERGY PROCESSES
Gorman, P.G., K.P. Ananth, and H.M. Freeman

Paper 40g
**EPA'S RESEARCH PROGRAM IN ENVIRONMENTAL CONTROL FOR WASTE-AS-FUEL PROCESSES
Olexsey, R.A., and G.L. Juffman

Session 122: Methods for Treating Liquid Point Source Wastes Emanating from Fossil Fuel Burning Power Plants

Paper 122a
**SELECTION OF FILTRATION EQUIPMENT FOR ASH LADEN WATER
Wykoff, R.W., and M.E. Loeb

Paper 122c
**DESIGN AND OPERATION OF A WASTEWATER TREATMENT FACILITY FOR AN OIL FIRED POWER PLANT
Carvalho, D.A., and D.K. Patel

Paper 122d
**MOBILE WASTEWATER TREATMENT FACILITIES IN A MULTI-GENERATING STATION UTILITY
Williams, A.L., and T.M. LaRonge

Session 123: Ultimate Disposition--?

Paper 123a
USE OF LANDFARMING FOR DISPOSAL OF PETROLEUM INDUSTRY WASTES
Rucker, E., and H.E. Knowlton

FFI contact Executive Secretary, American Institute of Chemical Engineers, 345 East 47th Street, New York, NY 10017

NOV 13- NOV 14 *American Petroleum Institute Annual Meeting, Chicago, Illinois, 1978
Sponsored by the American Petroleum Institute

FFI contact API, 2101 L Street NW, Washington, DC 20037

NOV 14- NOV 16 *International Pollution Engineering Conference and Exhibition, Houston, Texas, 1978
Sponsored by Clapp and Poliak

FFI contact P.W. Nathan, Vice-President, Clapp & Poliak, 245 Park Avenue, New York, NY 10017

DEC 4-5 Third Annual Toxic Substances Control Conference, Washington, DC, 1978
Sponsored by Government Institutes, Inc.

Papers focus on the so-called "upstream" factors of toxic substances and include short-term testing, procedures, monitoring, and relevant legislation. Oil pollution topics are covered. Proceedings are $25, available January 1979.

FFI contact Martin L. Heavner, Manager, Communications, Government Institutes, Inc., 4733 Bethesda Ave., NW, Washington, DC 20014.

DEC 5-9 *POLLUTEC '78, Second International Exhibition of Air - Noise - Waste and Water Techniques and the Control of Industrial and Urban Pollution, Paris, 1978

FFI contact Technoexpo, 8 Rue de la Michodiere, 75002 Paris, France.

DEC 6 Hazardous Wastes/RCRA Seminar, Washington, DC, 1978
Sponsored by Government Institutes, Inc.

The seminar, held in conjunction with the aforementioned Toxic Substances Control Conference, focuses on the "downstream" materials affected by the Resource Conservation and Recovery Act of 1976.

FFI contact Martin L. Heavner, Manager, Communications, Government Institutes, Inc., 4733 Bethesda Avenue, NW, Washington, DC 20014.

DEC 7 *Conference, 1978
Sponsored by the Royal Institute of Naval Architects, and the Institute of Marine Engineers

The purpose of the meeting is to examine and discuss new regulations agreed upon at the 1978 IMCO Tanker Safety and Pollution Prevention meetings which amended the 1972 MAROL and the 1974 SOLAS Conventions.

FFI contact Conference Officer, Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN, England

MAR 19- MAR 22 Conference on the Prevention, Behavior, Control, and Cleanup of Oil Pollution, 6th, Los Angeles, 1979

The Conference covers pollution prevention, development of new techniques for use in inland, coastal, deepwater and Arctic oil spill control operations, and pollution liability and damage assessment. Papers will focus on the following topics:

1) Cleanup operations;
2) Oil spill cooperatives;
3) Training Techniques;
4) Monitoring;
5) New Prevention and Control Techniques;
6) New Equipment Developments;
7) Oil Transfer Practices;
8) Dispersants;
9) Fate and Effects of Oil;
10) Natural Resource Damage Assessment; and
11) Socio-Economic-Legal Aspects (National and International).

FFI contact Dr. Charles Bates, Program Chairman, c/o U.S. Coast Guard (G-DS/62), Washington, DC 20590.

MASTER LIST OF KEYWORDS AND CROSS-REFERENCE GUIDE

S: See
SA: See also

Absorption
Activated sludge ... SA: Sludge
Acute effects
Adsorption
Africa
Alabama
Alaska
Algae ... SA: Phytoplankton
Amoco Cadiz spill
Amphipods
Analytical techniques ... SA: Chemical analysis, Chromatography, Source identification
Animals ... SA: Invertebrates, Marine mammals, Marine organisms, Vertebrates
Annelids ... SA: Polychaetes
Antarctica
API
Arctic ... SA: Subarctic regions
Arctic Ocean
Argentina
Argo Merchant spill
Aromatic hydrocarbons ... SA: Hydrocarbons, PAH
Asia
Atlantic coast ... SA: Coasts
Atlantic Ocean
Australia
Bacteria ... SA: Microorganisms
Bahamas
Ballast
Baltic Sea
Bantry Bay
Barent Sea
Baseline studies ... SA: EIS
Bays ... SA: Estuaries, Harbors
Beach cleanup
Beaches ... SA: Coasts, Shorelines
Beaufort Sea
Behavior ... SA: Fate
Belgium
Benthos ... SA: Invertebrates, Marine organisms
Bering Sea
Bermuda
Bibliographies
Bilges
Biodegradation
Biogenic hydrocarbons
Bioindicators
Biological effects ... SA: Toxicity, Acute effects, Chronic effects
Biological treatment
Biomass
Birds
Black Sea
BLM
Blowout prevention
Blowouts
Book review
Booms ... SA: Spill containment
Bouchard 65 spill
Brazil
Buzzards Bay
California
Canada
Carcinogens ... SA: Health hazards, PAH
Caribbean Sea
Caspian Sea
Chedabucto Bay
Chemical analysis ... SA: Analytical techniques, Chromatography, Source identification
Chemical effects
Chesapeake Bay
Chile
China
Chromatography ... SA: Analytical techniques, Chemical analysis
Chronic effects ... SA: Biological effects
Coalescence ... SA: Flocculation
Coastal zone management
Coasts
Compensation
Connecticut
Conservation
Contaminants

Contamination
Contingency planning
Corals
Coral reefs
Cost analysis ... SA: Economics
Crankcase oil ... SA: Lubricating oil
Crude oil
Crude oil washing
Crustaceans
Decomposition
Deepwater ports ... SA: Harbors, Oil terminals
Delaware
Delaware Bay
Denmark
Design-engineering
Detection ... SA: Monitoring, Chemical analysis
Development ... SA: Offshore development
Dispersants ... SA: Emulsifiers, Surfactants
Dispersion ... S: Drift, Movement, Spreading
Dispersions ... SA: Emulsions
Disposal ... SA: Waste oil disposal, Wastewater disposal
Distillation
Distribution
DOE
Drift ... SA: Movement, Spreading
Drilling ... SA: Offshore drilling, Oil wells, Platforms
Echinoderms
Economic effects
Economics ... SA: Cost analysis
Ecosystems
Ecuador
Effluent treatment ... S: Wastewater treatment
EIS ... SA: Baseline studies
Ekofisk blowout
Emulsification
Emulsifiers ... SA: Dispersants, Surfactants
Emulsions ... SA: Dispersions
Engineering ... S: Design-engineering
England ... SA: UK
English Channel
Environmental deterioration
Environmental effects
Environmental Impact Statement ... S: EIS
Environmental management ... SA: Coastal zone management
Environmental protection
EPA
Equipment ... SA: Product information
ERDA
Estuaries ... SA: Bays
Evaporation
Exploration ... SA: Offshore exploration, Production
Extraction
Fate ... SA: Behavior
FEA
Filtration ... SA: Flocculation, Ultrafiltration
Finland
Fish
Fisheries
Flocculation ... SA: Coalescence, Filtration
Florida
Florida spill
Flotation
Food chain ... S: Food web
Food web
Foreign governments ... S: Government agencies
Fossil fuels
France
Freshwater
Fuel oil
Fuels
Fungi ... SA: Microorganisms
Gas-liquid chromatography ... S: Chromatography
Gasoline
GC/MS ... SA: Chemical analysis, Chromatography, Spectrometry
Georges Bank
Georgia
Germany, East
Germany, West
Government agencies ... SA: BLM, DOE, EPA, ERDA, FEA, NOAA, USCG, USGS, USN; Foreign governments, State governments, US Government
Gravity separation ... SA: Oil-water separation
Great Lakes

Greenland
Groundwater
Growth
Guidelines ... SA: Manuals
Gulf of Alaska
Gulf of Mexico
Habitats
Harbors ... SA: Bays, Deepwater ports, Oil terminals
Health hazards ... SA: Carcinogens
Hydrocarbons ... SA: Aromatic hydrocarbons, Biogenic hydrocarbons, Crude oil, PAH
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Illinois
IMCO
Incineration
India
Indian Ocean
Indonesia
Industries ... SA: Oil industry
Information systems
Infrared spectroscopy ... S: Spectroscopy
Inland ... SA: Onshore impacts
Insurance
International agreements ... SA: Foreign governments
International conventions ... SA: Foreign governments, Legislation, Regulations
Intertidal zone
Invertebrates ... SA: Marine organisms
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Iraq
Ireland
Israel
Italy
Japan
Kuwait
Labrador Sea
Lakes ... SA: Great Lakes
Law enforcement
Leakage
Legislation ... SA: International conventions, Regulations
Liability
Louisiana
Lubricating oil
Maine
Manuals ... SA: Guidelines
Marine mammals ... SA: Animals, Vertebrates
Marine organisms
Marshes
Maryland
Massachusetts
Mass spectroscopy ... S: Spectroscopy
Mediterranean Sea
Metabolism ... SA: Growth, Release, Uptake
Metula spill
Mexico
Michigan
Microorganisms ... SA: Algae, Bacteria, Fungi, Yeasts
Middle East
Mississippi
Mississippi River
Models
Mollusks ... SA: Invertebrates
Monitoring ... SA: Detection, Remote sensing, Sampling
Mortality
Movement ... SA: Spreading, Drift
Narragansett Bay
Natural seepage
Neuston
New Hampshire
New Jersey
New Mexico
New York
Niches
NOAA
North Carolina
North Sea
Norway
Oceans ... SA: Sea surface, Seawater
OCS
Offshore development
Offshore drilling
Offshore exploration
Offshore production
Oil ... S: Crankcase oil, Crude oil, Fuel oil, Lubricating oil, Petroleum products, Waste oil
Oil discharges
Oil fields ... SA: Production
Oil-gas leasing
Oil industry
Oil shale
Oil slicks

Oil spills
Oil tanks
Oil terminals ... SA: Deepwater ports, Harbors, Ports
Oil transfer
Oil transport ... SA: Tankers
Oil-water separation ... SA: Wastewater treatment
Oil wells ... SA: Drilling, Production, Offshore drilling, Offshore production
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Onshore impacts ... SA: Inland
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Oxidation ... SA: Biodegradation, Weathering
Pacific Ocean
PAH ... SA: Hydrocarbons
Patent
Pennsylvania
Personnel training
Petrochemicals
Petroleum ... S: Crude oil
Petroleum industry ... S: Oil industry
Petroleum products
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Philippines
Physical effects
Phytoplankton
Pipelines
Plankton ... S: Phytoplankton, Zooplankton
Plants ... SA: Vegetation
Platforms ... SA: Offshore drilling
Pollution control
Pollution prevention ... SA: Environmental protection, Contingency planning
Polychaetes ... S: Annelids
Ports ... SA: Harbors, Oil terminals
Portugal
Precipitation
Product information ... SA: Equipment
Production ... SA: Offshore production, Drilling, Offshore drilling
Prudhoe Bay
Puerto Rico
Puget Sound
Reclamation ... SA: Recycling, Reuse
Recovery ... SA: Restoration
Recycling ... SA: Reclamation, Reuse
Red Sea
Refineries
Refining
Regulations ... SA: Legislation, International conventions
Release ... SA: Growth, Metabolism, Uptake
Remote sensing ... SA: Detection, Monitoring
Reproduction
Residual oils
Resource management ... SA: Environmental management
Restoration ... SA: Recovery
Reuse ... SA: Reclamation, Recycling
Rhine River
Rhode Island
Rivers ... SA: Streams
Safety ... SA: Health hazards
Sampling ... SA: Detection, Monitoring, Source identification
San Francisco Bay
Santa Barbara Channel
Sargasso Sea
Saudi Arabia
Scotland
Sea surface ... SA: Oceans
Seawater
Sedimentation
Sediments
Segregated ballast
Ships ... SA: Tankers
Shorelines ... SA: Beaches, Coasts
Sinking agents
Skimmers ... SA: Spill cleanup
Sludge ... SA: Activated sludge
Social effects
Socioeconomic effects
Soil
Solid wastes ... SA: Sludge
Solubility
Solution
Solvents
Sorbents ... SA: Absorption, Adsorption
Source identification
Sources
South Carolina
Spain
Spectrometry

Spectroscopy
Spill cleanup
Spill containment
Spill disposal
Spill removal
Spreading ... SA: Drift, Movement
St. Lawrence River
State governments ... SA: US Government, Government agencies
Statistical analysis
Statistics
Storage
Strait of Gibraltar
Strait of Magellan
Streams ... SA: Rivers
Subarctic regions ... SA: Arctic
Sublethal effects
Superports ... S: Oil terminals, Ports
Supertankers ... S: Tankers
Surfactants ... SA: Dispersants, Emulsifiers
Surveillance
Sweden
Syria
Tankers ... SA: Ships
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Tar sands
Texas
Torrey Canyon spill
Toxicity ... SA: Biological effects
Tropical regions
Turkey
UK ... SA: England
Ultrafiltration ... SA: Filtration
UN
Uptake ... SA: Growth, Metabolism, Release
Urquiola spill
US
USCG
US Government ... SA: State governments, Government agencies
USGS
USN
USSR
Vegetation ... SA: Plants
Venezuela
Vertebrates ... SA: Animals, Marine mammals
Vietnam
Virgin Islands
Virginia
Washington
Waste oil
Waste oil treatment
Wastewaters
Wastewater treatment ... SA: Oil-water separation
Water quality
Water soluble fraction ... S: WSF
Weathering
West Indies
Wildlife
WSF
Yeasts ... SA: Microorganisms
Yugoslavia
Zooplankton ... SA: Plankton

KEYWORD INDEX

THE KEYWORD INDEX IS A PERMUTED INDEX THAT LISTS ALPHABETICALLY THE KEYWORDS AND CORRESPONDING CITATION NUMBER ASSIGNED TO EACH ABSTRACT IN SECTION I (C-   -78) AND IN SECTION II (R-   -78). THESE KEYWORDS ARE SELECTED FROM THE MASTER LIST, P. 228. FREE LANGUAGE TERMS WHICH ARE INCLUDED TO GIVE MORE SPECIFIC INFORMATION ABOUT AN ENTRY ARE PRECEDED BY AN * SIGN.

0788 ABSORPTION, SPILL REMOVAL, *FOAM, *POLYURETHANE,
0789 ABSORPTION, SPILL CLEANUP, FUEL OIL, *DIESEL OIL, *POLYURETHANE FOAM,
0794 ABSORPTION, SPILL REMOVAL, PATENT, SEA SURFACE, BEACH CLEANUP,
0799 ABSORPTION, SPILL REMOVAL, SOLVENTS, PATENT, *POLYMERS,
0810 ABSORPTION, SPILL REMOVAL, PATENT,
0815 ABSORPTION, SPILL REMOVAL, DISTILLATION, PATENT, *CEMENT,
0819 ABSORPTION, SPILL REMOVAL, PATENT, *FIBER MATERIAL,
0833 ABSORPTION, EMULSIONS, WASTEWATER TREATMENT, *COAGULATION, FLOCCULATION, PATENT,
0839 ABSORPTION, SLUDGE , OIL-WATER SEPARATION, PATENT,
0850 ABSORPTION, INCINERATION, *ATOMIZATION, WASTEWATER, WASTE OIL, PATENT,
0884 ABSORPTION, OIL-WATER SEPARATION, SORBENTS, PATENT,
1027 ABSORPTION, ADSORPTION, CRUDE OIL, SEDIMENTS, MOLLUSKS, UPTAKE, *OYSTERS,
0871 ACTIVATED SLUDGE, REFINERIES, OIL INDUSTRY, *ACTIVATED CARBON, *EFFLUENT QUALITY,
1076 ACTIVATED SLUDGE, BIODEGRADATION, TOXICITY, WASTEWATERS, MARINE ORGANISMS, YEASTS, FOOD WEB,
R063 ACTIVATED SLUDGE, WASTEWATERS, REFINERIES, SAMPLING, *RESIDUALS, *PNA,
R082 ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, BIOASSAY, FISH, GROWTH, PHYTOPLANKTON, WATER QUALITY,
0711 ACUTE EFFECTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, MARINE ORGANISMS, COASTS, FRANCE,
0773 ACUTE EFFECTS, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, BIOLOGICAL EFFECTS, TOXICITY, SUBLETHAL EFFECTS,
0944 ACUTE EFFECTS, TOXICITY, CRUDE OIL, BIOASSAY, AROMATIC HYDROCARBONS, *MORONE SAXATILIS, *CRANGON FRANCISCORUM,
0985 ACUTE EFFECTS, CRUDE OIL, FISH, MORTALITY, GROWTH, BIOASSAY, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
0991 ACUTE EFFECTS, CRUDE OIL, DISPERSANTS, TOXICITY, CRUSTACEANS, MORTALITY, ARCTIC, *COREXIT 9527,
R111 ACUTE EFFECTS, CRUDE OIL, MARSHES, ESTUARIES, FOOD WEB, CHEMICAL EFFECTS, RECOVERY,
0768 ADSORPTION, CHEMICAL ANALYSIS, EXTRACTION, CONTAMINANTS, *MACRORETICULAR RESINS,
0787 ADSORPTION, SPILL CLEANUP, *PEAT AND FIBERS, *REVIEW,
0790 ADSORPTION, SPILL REMOVAL, PATENT, *PERLITE,
0793 ADSORPTION, SPILL CLEANUP, EMULSIONS, PATENT, *EXPANDED PYROPHYLLITE,
0795 ADSORPTION, SPILL REMOVAL, SORBENTS, SURFACTANTS, PATENT,
0796 ADSORPTION, SPILL CLEANUP, PATENT, *SORBENT KAPOK FIBERS,
0804 ADSORPTION, SPILL REMOVAL, PATENT, *SHAPED PITCH,
0809 ADSORPTION, SORBENTS, PATENT, SPILL CLEANUP, *ATTAPULGITE,
0826 ADSORPTION, WASTEWATERS, INDUSTRIES, OIL-WATER SEPARATION, *AGENT NT75,
0836 ADSORPTION, WASTEWATER TREATMENT, EMULSIONS, PATENT,
0848 ADSORPTION, WASTEWATER TREATMENT, PETROCHEMICALS, AROMATIC HYDROCARBONS, *ACTIVATED CARBON,
0868 ADSORPTION, WASTEWATER TREATMENT, SLUDGE , *SAND-OIL BINDER LAYER,
0897 ADSORPTION, OIL-WATER SEPARATION, BILGES, WASTEWATERS, SEAWATER, FILTRATION , EQUIPMENT, PATENT,
0905 ADSORPTION, OIL-WATER SEPARATION, SORBENTS, PATENT,
0906 ADSORPTION, OIL-WATER SEPARATION, LUBRICATING OIL, PATENT,
0907 ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, PATENT, *SORBENT GAUZE,
0909 ADSORPTION, OIL-WATER SEPARATION, EQUIPMENT, GRAVITY SEPARATION, WASTEWATERS, PATENT,
1027 ADSORPTION, ABSORPTION, CRUDE OIL, SEDIMENTS, MOLLUSKS, UPTAKE, *OYSTERS,
1095 ADSORPTION, FLOCCULATION, SEDIMENTATION, EMULSIONS, COAGULATION, *COLLOIDS,
R096 ADSORPTION, HYDROCARBONS , BIOGENIC HYDROCARBONS, SEDIMENTATION, ENVIRONMENTAL EFFECTS, ESTUARIES, MONITORING,
0774 ALGAE, CHEMICAL ANALYSIS, WSF, FUEL OIL, PHYTOPLANKTON, TOXICITY, GROWTH,
0950 ALGAE, BACTERIA, TOXICITY, CHEMICAL EFFECTS, CHEMICAL ANALYSIS, *TGK VALUES,
0955 ALGAE, WSF, BIOLOGICAL EFFECTS, GROWTH, CRUDE OIL, FUEL OIL, FRESHWATER,
0961 ALGAE, DISPERSANTS, BIOLOGICAL EFFECTS, TOXICITY, *CELL MEMBRANES, *NITELLA FLEXILIS,
0964 ALGAE, BIOLOGICAL EFFECTS, HYDROCARBONS , WSF, MARINE ORGANISMS, INVERTEBRATES, *PROCEEDINGS,
0967 ALGAE, BIOLOGICAL EFFECTS, CRUDE OIL, DISPERSANTS, PHYTOPLANKTON, *COREXIT, *PRIMARY PRODUCTION,

R097 ALGAE, CRUDE OIL, ZOOPLANKTON, BENTHOS, BIOLOGICAL EFFECTS, ARCTIC, *TUNDRA PONDS,
0711 AMOCO CADIZ SPILL, ACUTE EFFECTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, COASTS, FRANCE,
0716 AMOCO CADIZ SPILL, ENVIRONMENTAL EFFECTS, FRANCE,
0722 AMOCO CADIZ SPILL, BEACH CLEANUP, ENVIRONMENTAL EFFECTS, COASTS, MARSHES, MARINE ORGANISMS, FISHERIES, FRANCE,
0726 AMOCO CADIZ SPILL, ENVIRONMENTAL EFFECTS, MORTALITY, MARINE ORGANISMS, INTERTIDAL ZONE, FRANCE,
0824 AMOCO CADIZ SPILL, TANKERS, IMCO, INTERNATIONAL CONVENTIONS, SEGREGATED BALLAST, POLLUTION PREVENTION, SAFETY,
1003 AMOCO CADIZ SPILL, BIRDS, TORREY CANYON SPILL, RECOVERY, CONTAMINATION,
1032 AMOCO CADIZ SPILL, SPILL REMOVAL, BEACH CLEANUP, COASTS, BIOLOGICAL EFFECTS, FRANCE,
1141 AMOCO CADIZ SPILL, SAFETY, TANKERS, OIL SPILLS, ENVIRONMENTAL PROTECTION, *NEGOTIATIONS,
1144 AMOCO CADIZ SPILL, COMPENSATION, SPILL CLEANUP, *CRISTAL,
1146 AMOCO CADIZ SPILL, TANKERS, IMCO, INTERNATIONAL AGREEMENTS, SEGREGATED BALLAST, CRUDE OIL WASHING, SAFETY,
R110 AMOCO CADIZ SPILL, COASTS, DISPERSIONS, BEACH CLEANUP, SPILL REMOVAL, SEDIMENTATION, BEHAVIOR,
0952 AMPHIPODS, TOXICITY, OIL SPILLS, ARCTIC, HYDROCARBONS ,
0979 AMPHIPODS, TOXICITY, FUEL OIL, CRUSTACEANS, *EXPERIMENTAL VARIABLES, *NEOHAUSTORIUS SCHMITZI,
0745 ANALYTICAL TECHNIQUES, SAMPLING, CONTAMINATION, *NISKIN BOTTLES,
0749 ANALYTICAL TECHNIQUES, PAH, DISTILLATION, SPECTROMETRY, CHROMATOGRAPHY,
0758 ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, CRUDE OIL, OIL SHALE, *COAL OIL,
0761 ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, WASTEWATERS, GROUNDWATER,
0763 ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, DETECTION, SEAWATER,
0766 ANALYTICAL TECHNIQUES, *DUAL-WAVELENGTH SPECTROPHOTOMETRY, WASTEWATERS, *DISPERSED OIL,
0773 ANALYTICAL TECHNIQUES, ACUTE EFFECTS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, TOXICITY, SUBLETHAL EFFECTS,
1022 ANALYTICAL TECHNIQUES, RIVERS, WASTEWATERS, CONTAMINANTS, SOURCES, BIOLOGICAL EFFECTS,
1036 ANALYTICAL TECHNIQUES, POLLUTION CONTROL, WASTEWATER TREATMENT, *REVIEW,
1169 ANALYTICAL TECHNIQUES, FISH, TOXICITY, CONTAMINANTS, BEHAVIOR,
R061 ANALYTICAL TECHNIQUES, SAMPLING, BENTHOS, BIOLOGICAL EFFECTS, OIL SPILLS, BUZZARDS BAY, *X-RAY RADIOGRAPHY,
R064 ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, CONTAMINANTS, TOXICITY, SAMPLING,
R065 ANALYTICAL TECHNIQUES, BIOASSAY, TOXICITY, REFINERIES, WASTEWATERS, FRESHWATER, INTERTIDAL ZONE, INVERTEBRATES, FISH,
R069 ANALYTICAL TECHNIQUES, DETECTION, HYDROCARBONS , USN, *OIL/GREASE IN WATER,
R070 ANALYTICAL TECHNIQUES, HYDROCARBONS , SEAWATER, SEDIMENTS, *ANIMAL TISSUES,
R109 ANALYTICAL TECHNIQUES, HYDROCARBONS , MARINE ORGANISMS, ECOSYSTEMS, FATE, TOXICITY, ENVIRONMENTAL EFFECTS, SUBARCTIC REGIONS, NOAA,
R121 ANALYTICAL TECHNIQUES, RESOURCE MANAGEMENT, DRILLING , CONTAMINATION, GROUNDWATER, ECONOMIC EFFECTS, *ENHANCED OIL RECOVERY , *WATER RESOURCES,
R132 ANALYTICAL TECHNIQUES, BIODEGRADATION, BACTERIA, MICROORGANISMS, CHEMICAL ANALYSIS,
R081 ANIMALS, WASTEWATERS, CONTAMINANTS, TOXICITY, HEALTH HAZARDS, PAH,
R115 ANIMALS, MARINE MAMMALS, FOOD WEB, DEVELOPMENT , HABITATS, PIPELINES, ARCTIC,
1015 ANTARCTICA, RECOVERY, STATISTICAL ANALYSIS, FUEL OIL, CONTAMINATION,
0920 API, PERSONNEL TRAINING, MANUALS, STATISTICS, OIL SPILLS,
1005 API, BIRDS, RESTORATION, BOOK REVIEW,
1125 API, STATE GOVERNMENTS, RESOURCE MANAGEMENT, COASTAL ZONE MANAGEMENT,
R062 API, SOLID WASTES, REFINERIES, TOXICITY, SLUDGE , EPA, *TANK CLEANING, WATER QUALITY,
R147 API, WATER QUALITY, OIL INDUSTRY, POLLUTION CONTROL, STATISTICAL ANALYSIS, EPA,
R148 API, COST ANALYSIS, ENVIRONMENTAL PROTECTION, REGULATIONS,
R149 API, MODELS, GUIDELINES, STATISTICAL ANALYSIS, REFINERIES, WASTEWATERS, COST ANALYSIS, EPA,
R150 API, COST ANALYSIS, ENVIRONMENTAL PROTECTION,
0801 ARCTIC, SPILL CLEANUP, SPILL REMOVAL, EQUIPMENT, *AMOP,
0952 ARCTIC, AMPHIPODS, TOXICITY, OIL SPILLS, HYDROCARBONS ,
0970 ARCTIC, PHYTOPLANKTON, PETROLEUM PRODUCTS, DISPERSANTS, MORTALITY, *COREXIT 7664, *DIPROKSAMIN 157,
0991 ARCTIC, ACUTE EFFECTS, CRUDE OIL, DISPERSANTS, TOXICITY, CRUSTACEANS, MORTALITY, *COREXIT 9527,
0992 ARCTIC, CRUDE OIL, BIODEGRADATION, BIOLOGICAL EFFECTS, MICROORGANISMS, SOIL,
1069 ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, BENTHOS, INVERTEBRATES, MORTALITY, *RECOLONIZATION,
1079 ARCTIC, BIODEGRADATION, MICROORGANISMS, CRUDE OIL,
1174 ARCTIC, POLLUTION PREVENTION, POLLUTION CONTROL, BIOLOGICAL EFFECTS, *RESEARCH PROPOSALS, *AMOP,
R097 ARCTIC, ALGAE, CRUDE OIL, ZOOPLANKTON, BENTHOS, BIOLOGICAL EFFECTS, *TUNDRA PONDS,
R098 ARCTIC, CRUDE OIL, FATE, ENVIRONMENTAL EFFECTS, DECOMPOSITION, PLANTS, *TUNDRA,
R115 ARCTIC, ANIMALS, MARINE MAMMALS, FOOD WEB, DEVELOPMENT , HABITATS, PIPELINES,
1052 ARCTIC OCEAN, BASELINE STUDIES, COASTS, MARINE MAMMALS, CANADA,
1078 ARCTIC OCEAN, BIODEGRADATION, BACTERIA, MICROORGANISMS, HYDROCARBONS ,
0714 ARGENTINA, CONTAMINATION, ENVIRONMENTAL DETERIORATION,
0720 ARGO MERCHANT SPILL, TANKERS, STATISTICAL ANALYSIS,

0741 ARGO MERCHANT SPILL, SAMPLING, SEDIMENTS, CRUDE OIL, CHROMATOGRAPHY, *FIELD METHOD,
0800 ARGO MERCHANT SPILL, SPILL CLEANUP, EQUIPMENT, MONITORING, FATE, *ACCIDENT RESPONSE,
1114 ARGO MERCHANT SPILL, FATE, BEHAVIOR, NORTH SEA, SPILL CLEANUP,
0742 AROMATIC HYDROCARBONS, SAMPLING, CHEMICAL ANALYSIS, MARINE ORGANISMS, BENTHOS, CRUDE OIL, NORWAY,
0769 AROMATIC HYDROCARBONS, FUEL OIL, SEDIMENTS, MARSHES, CHROMATOGRAPHY, SPECTROMETRY, BUZZARDS BAY,
0848 AROMATIC HYDROCARBONS, ADSORPTION, WASTEWATER TREATMENT, PETROCHEMICALS, *ACTIVATED CARBON,
0872 AROMATIC HYDROCARBONS, CARCINOGENS, DISPOSAL , WASTE OIL, LUBRICATING OIL, REFINING, RECLAMATION,
0892 AROMATIC HYDROCARBONS, OIL-WATER SEPARATION, HYDROCARBONS , PATENT, *MEMBRANES,
0944 AROMATIC HYDROCARBONS, ACUTE EFFECTS, TOXICITY, CRUDE OIL, BIOASSAY, *MORONE SAXATILIS, *CRANGON FRANCISCORUM,
0958 AROMATIC HYDROCARBONS, TOXICITY, *MUTAGENICITY, *BIOTRANSFORMATIONS, *REVIEW,
0989 AROMATIC HYDROCARBONS, METABOLISM, PAH, FISH, CHROMATOGRAPHY, *ONCORHYNCHUS KISUTCH,
1023 AROMATIC HYDROCARBONS, TOXICITY, *ALIPHATIC HYDROCARBONS, *REVIEW,
1060 AROMATIC HYDROCARBONS, BASELINE STUDIES, SEAWATER, SAMPLING, DEEPWATER PORTS, SPECTROSCOPY, GULF OF MEXICO,
1084 AROMATIC HYDROCARBONS, BIODEGRADATION, MARINE ORGANISMS, METABOLISM, OXIDATION, *ENZYME SYSTEMS,
1106 AROMATIC HYDROCARBONS, SOURCES, DISTRIBUTION, FATE, BIODEGRADATION,
1113 AROMATIC HYDROCARBONS, SAMPLING, INTERTIDAL ZONE, BIODEGRADATION, MICROORGANISMS, YUGOSLAVIA,
R091 AROMATIC HYDROCARBONS, CARCINOGENS, MARINE ORGANISMS, HEALTH HAZARDS, TOXICITY, *PNA,
0931 ATLANTIC COAST, OFFSHORE DRILLING, OCS, RESOURCE MANAGEMENT, DISPOSAL , MODELS, POLLUTION PREVENTION, *WORKSHOP,
0950 BACTERIA, ALGAE, TOXICITY, CHEMICAL EFFECTS, CHEMICAL ANALYSIS, *TGK VALUES,
0953 BACTERIA, TOXICITY, WSF, CRUDE OIL, HYDROCARBONS , WASTE OIL, MOLLUSKS, SUBLETHAL EFFECTS, MORTALITY,
0960 BACTERIA, ESTUARIES, MARSHES, MICROORGANISMS, BIODEGRADATION, BIOLOGICAL EFFECTS,
0968 BACTERIA, HYDROCARBONS , BIOLOGICAL EFFECTS, *CO2 FIXATION,
0975 BACTERIA, REFINERIES, WASTEWATERS, ENVIRONMENTAL EFFECTS, BIODEGRADATION, PHYTOPLANKTON, INTERTIDAL ZONE,
0980 BACTERIA, MICROORGANISMS, PETROLEUM PRODUCTS, DISPERSANTS, *DIPROKSAMIN 157, *COREXIT 7664,
1018 BACTERIA, BIODEGRADATION, RECOVERY, MICROORGANISMS, SEDIMENTS, DISTRIBUTION, CHEDABUCTO BAY,
1068 BACTERIA, BIODEGRADATION, WASTE OIL, DISPOSAL , SOIL, *BIODISPOSAL FARMING,
1071 BACTERIA, BIODEGRADATION, MICROORGANISMS, WEATHERING, METULA SPILL, STRAIT OF MAGELLAN,
1074 BACTERIA, BIODEGRADATION, MICROORGANISMS, FUNGI, YEASTS, HYDROCARBONS ,
1075 BACTERIA, BIODEGRADATION, DISTRIBUTION, HYDROCARBONS , JAPAN, *BISAN SETO,
1078 BACTERIA, ARCTIC OCEAN, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS ,
1081 BACTERIA, BIODEGRADATION, PETROLEUM PRODUCTS, SEAWATER,
1083 BACTERIA, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS , YEASTS, FUNGI, *REVIEW,
1085 BACTERIA, BIODEGRADATION, HYDROCARBONS , GROWTH,
1086 BACTERIA, BIODEGRADATION, SPILL CLEANUP,
1088 BACTERIA, BIODEGRADATION, HYDROCARBONS , MICROORGANISMS, YEASTS, FUNGI, SOIL,
1089 BACTERIA, BIODEGRADATION, FUNGI, MICROORGANISMS, SOIL, HYDROCARBONS ,
1090 BACTERIA, BIODEGRADATION, GASOLINE, GROUNDWATER, CONTAMINATION,
R099 BACTERIA, CRUDE OIL, CONTAMINANTS, SEAWATER, SUBLETHAL EFFECTS, MICROORGANISMS, *CHEMOTAXIS,
R127 BACTERIA, BIODEGRADATION, FUNGI, CRUDE OIL, MARSHES, ESTUARIES, SEDIMENTS,
R132 BACTERIA, ANALYTICAL TECHNIQUES, BIODEGRADATION, MICROORGANISMS, CHEMICAL ANALYSIS,
R133 BACTERIA, BIODEGRADATION, CRUDE OIL, SEA SURFACE, SEDIMENTS, OCEANS, ESTUARIES, *WATER COLUMN,
1059 BAHAMAS, DEEPWATER PORTS, TANKERS, OIL SPILLS, ENVIRONMENTAL PROTECTION,
1103 BAHAMAS, TAR, DISTRIBUTION, SAMPLING, BEACHES,
0734 BALLAST , MONITORING, INCINERATION, OIL-WATER SEPARATION, SHIPS, POLLUTION PREVENTION, WASTEWATERS,
0840 BALLAST , OIL-WATER SEPARATION, FILTRATION , GRAVITY SEPARATION, COALESCENCE, PATENT, *DEWAXING UNIT,
0854 BALLAST , WASTEWATER TREATMENT, TANKERS, INDUSTRIES, *REVIEW,
0925 BALLAST , PRODUCT INFORMATION, MONITORING, BILGES, SPILL REMOVAL, POLLUTION PREVENTION,
R089 BALLAST , PHYTOPLANKTON, TOXICITY, MONITORING, ALASKA,
0803 BALTIC SEA, SURFACTANTS, EMULSIONS, SPILL CLEANUP, DISPERSANTS, TANKERS,
1004 BALTIC SEA, CONTAMINATION, BIRDS, MORTALITY, RECOVERY,
1014 BALTIC SEA, RECOVERY, MARINE ORGANISMS, CHRONIC EFFECTS, INTERTIDAL ZONE, *FUCUS VESICULOSUS, *IRINI SPILL,
1052 BASELINE STUDIES, ARCTIC OCEAN, COASTS, MARINE MAMMALS, CANADA,
1053 BASELINE STUDIES, MARINE ORGANISMS, SEDIMENTS, DISTRIBUTION, BIOGENIC HYDROCARBONS, MEXICO , *N-PARAFFINS,
1054 BASELINE STUDIES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BLM, OCS, *EDITORIAL,
1057 BASELINE STUDIES, EIS, OIL SHALE, DEVELOPMENT , POLLUTION CONTROL, RESOURCE MANAGEMENT,
1060 BASELINE STUDIES, AROMATIC HYDROCARBONS, SEAWATER, SAMPLING, DEEPWATER PORTS, SPECTROSCOPY, GULF OF MEXICO,

1061 BASELINE STUDIES, SAMPLING, HYDROCARBONS , PUGET SOUND, MODELS,
1063 BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, BIRDS, MICROORGANISMS, ALASKA,
1064 BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, FISH, PLANKTON , BENTHOS, INTERTIDAL ZONE, ALASKA,
1065 BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, SAFETY, STATISTICS, ALASKA, *HAZARDS,
R122 BASELINE STUDIES, OIL SHALE, FISH, WILDLIFE, ENVIRONMENTAL EFFECTS, *POPULATION REDUCTIONS,
R123 BASELINE STUDIES, ENVIRONMENTAL MANAGEMENT, DEVELOPMENT , HYDROCARBONS , MARINE ORGANISMS, MODELS, PUGET SOUND,
R124 BASELINE STUDIES, FISHERIES, GULF OF MEXICO, *MACKEREL,
1105 BAYS, FUEL OIL, HYDROCARBONS , CHROMATOGRAPHY, BIODEGRADATION, FATE, SOURCE IDENTIFICATION, CANADA, *PENTACYCLIC TRITERPANES,
0722 BEACH CLEANUP, AMOCO CADIZ SPILL, ENVIRONMENTAL EFFECTS, COASTS, MARSHES, MARINE ORGANISMS, FISHERIES, FRANCE,
0794 BEACH CLEANUP, ABSORPTION, SPILL REMOVAL, PATENT, SEA SURFACE,
0798 BEACH CLEANUP, SPILL REMOVAL, SEDIMENTS, PATENT,
1016 BEACH CLEANUP, DISPERSANTS, RECOVERY, *RECOLONIZATION, SHORELINES, MARINE ORGANISMS, TORREY CANYON SPILL, UK,
1032 BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL, COASTS, BIOLOGICAL EFFECTS, FRANCE,
R110 BEACH CLEANUP, AMOCO CADIZ SPILL, COASTS, DISPERSIONS, SPILL REMOVAL, SEDIMENTATION, BEHAVIOR,
1028 BEACHES, CONTAMINATION, SEAWATER, SOIL, HYDROCARBONS , PETROLEUM PRODUCTS, USSR,
1103 BEACHES, BAHAMAS, TAR, DISTRIBUTION, SAMPLING,
R094 BEACHES, BIRDS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ALASKA,
0873 BEAUFORT SEA, WASTEWATERS, DISPOSAL , OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, *DRILLING MUD,
1046 BEAUFORT SEA, OIL SPILLS, DISPERSIONS, BIODEGRADATION, FATE, MEDITERRANEAN SEA,
1062 BEAUFORT SEA, OCS, ENVIRONMENTAL EFFECTS, CRUDE OIL, OFFSHORE DEVELOPMENT, GULF OF ALASKA, BLM,
0946 BEHAVIOR, BIOLOGICAL EFFECTS, WSF, FUEL OIL, CRUSTACEANS, *CANCER IRRORATUS,
0969 BEHAVIOR, SUBLETHAL EFFECTS, WSF, CRUDE OIL, GROWTH, *FEEDING RATES, *MERCENARIA MERCENARIA,
0974 BEHAVIOR, WSF, FUEL OIL, ZOOPLANKTON, SUBLETHAL EFFECTS, *LUCIFER FAXONI,
0994 BEHAVIOR, FUEL OIL, MOLLUSKS, TOXICITY, UPTAKE, RELEASE, *RESPIRATION, *MYA ARENARIA,
1096 BEHAVIOR, OIL SLICKS, ICE, FRESHWATER, SOLUTION, SPILL CLEANUP,
1100 BEHAVIOR, FATE, MODELS, MOVEMENT, DISPERSIONS,
1114 BEHAVIOR, ARGO MERCHANT SPILL, FATE, NORTH SEA, SPILL CLEANUP,
1122 BEHAVIOR, OIL SPILLS, SPREADING, MODELS, EKOFISK BLOWOUT, *OILSIM,
1169 BEHAVIOR, ANALYTICAL TECHNIQUES, FISH, TOXICITY, CONTAMINANTS,
1170 BEHAVIOR, OIL SLICKS, SPILL CONTAINMENT, *FLUME,
R087 BEHAVIOR, SOURCE IDENTIFICATION, FATE, OIL SPILLS, SPILL CLEANUP, SURVEILLANCE, POLLUTION PREVENTION,
R095 BEHAVIOR, CRUSTACEANS, GROWTH, DEVELOPMENT , *LARVAE, *HOMARUS AMERICANUS,
R100 BEHAVIOR, CRUDE OIL, HYDROCARBONS , INVERTEBRATES, FISH, BIOLOGICAL EFFECTS, DEVELOPMENT , GROWTH,
R110 BEHAVIOR, BEACH CLEANUP, AMOCO CADIZ SPILL, COASTS, DISPERSIONS, SPILL REMOVAL, SEDIMENTATION,
R135 BEHAVIOR, OIL SLICKS, DISPERSIONS, FATE, MODELS,
R146 BEHAVIOR, MODELS, OIL SPILLS, FATE, *PREDICTIONS,
0742 BENTHOS, AROMATIC HYDROCARBONS, SAMPLING, CHEMICAL ANALYSIS, MARINE ORGANISMS, CRUDE OIL, NORWAY,
0747 BENTHOS, HYDROCARBONS , SEDIMENTS, INTERTIDAL ZONE, CHROMATOGRAPHY, RELEASE, *RECRUITMENT,
0990 BENTHOS, FLORIDA SPILL, MARINE ORGANISMS, INTERTIDAL ZONE, SEDIMENTS, STATISTICAL ANALYSIS, BUZZARDS BAY,
1008 BENTHOS, FUEL OIL, INVERTEBRATES, RESTORATION, RECOVERY, MARSHES, BOUCHARD 65 SPILL, BUZZARDS BAY,
1010 BENTHOS, RECOVERY, REFINERIES, WASTEWATER TREATMENT, CHRONIC EFFECTS, DISTRIBUTION, BIOMASS, *RECOLONIZATION,
1064 BENTHOS, BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, FISH, PLANKTON , INTERTIDAL ZONE, ALASKA,
1069 BENTHOS, ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, INVERTEBRATES, MORTALITY, *RECOLONIZATION,
R061 BENTHOS, ANALYTICAL TECHNIQUES, SAMPLING, BIOLOGICAL EFFECTS, OIL SPILLS, BUZZARDS BAY, *X-RAY RADIOGRAPHY,
R097 BENTHOS, ARCTIC, ALGAE, CRUDE OIL, ZOOPLANKTON, BIOLOGICAL EFFECTS, *TUNDRA PONDS,
R142 BENTHOS, HYDROCARBONS , SEAWATER, SEDIMENTS, CHEMICAL ANALYSIS, FATE, SARGASSO SEA, *TRANSPORT ,
1151 BIBLIOGRAPHIES, DISPERSANTS, FATE, ENVIRONMENTAL EFFECTS, CANADA,
1152 BIBLIOGRAPHIES, OCEANS, ESTUARIES,
1153 BIBLIOGRAPHIES, ESTUARIES, COASTS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, DEVELOPMENT ,

1154 BIBLIOGRAPHIES, TANKERS, PORTS , ENVIRONMENTAL EFFECTS, OIL SPILLS, *SUPERTANKERS, DEEPWATER PORTS,
1155 BIBLIOGRAPHIES, TANKERS, PORTS , ENVIRONMENTAL EFFECTS, *SUPERTANKERS, DEEPWATER PORTS,
1156 BIBLIOGRAPHIES, TOXICITY, *INFORMATION SOURCES , ENVIRONMENTAL EFFECTS,
0861 BILGES, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *DECANTATION TANKS,
0897 BILGES, ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, SEAWATER, FILTRATION , EQUIPMENT, PATENT,
0925 BILGES, BALLAST , PRODUCT INFORMATION, MONITORING, SPILL REMOVAL, POLLUTION PREVENTION,
0748 BIOASSAY, GROWTH, PHYTOPLANKTON, HYDROCARBONS , UPTAKE, *EXPERIMENTAL DESIGN, *BENZENE,
0754 BIOASSAY, BIOLOGICAL EFFECTS, TOXICITY, MONITORING, SOURCES, *BIOLOGICAL TESTS,
0944 BIOASSAY, AROMATIC HYDROCARBONS, ACUTE EFFECTS, TOXICITY, CRUDE OIL, *MORONE SAXATILIS, *CRANGON FRANCISCORUM,
0985 BIOASSAY, ACUTE EFFECTS, CRUDE OIL, FISH, MORTALITY, GROWTH, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
1165 BIOASSAY, BIOINDICATORS, MOLLUSKS, UPTAKE, *MERCURY, *FIELD TECHNIQUE,
1172 BIOASSAY, TOXICITY, WATER QUALITY, REFINERIES, WASTEWATERS, *DAPHNIA,
R065 BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, REFINERIES, WASTEWATERS, FRESHWATER, INTERTIDAL ZONE, INVERTEBRATES, FISH,
R082 BIOASSAY, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, FISH, GROWTH, PHYTOPLANKTON, WATER QUALITY,
R088 BIOASSAY, DISPERSANTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, TOXICITY,
R116 BIOASSAY, TOXICITY, *DRILLING MUDS, MARINE ORGANISMS, GULF OF MEXICO,
0784 BIODEGRADATION, SPILL CLEANUP, DISPERSANTS, *COMBUSTION, *COASTAL WATERS,
0960 BIODEGRADATION, BACTERIA, ESTUARIES, MARSHES, MICROORGANISMS, BIOLOGICAL EFFECTS,
0975 BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, ENVIRONMENTAL EFFECTS, PHYTOPLANKTON, INTERTIDAL ZONE,
0992 BIODEGRADATION, ARCTIC, CRUDE OIL, BIOLOGICAL EFFECTS, MICROORGANISMS, SOIL,
1018 BIODEGRADATION, BACTERIA, RECOVERY, MICROORGANISMS, SEDIMENTS, DISTRIBUTION, CHEDABUCTO BAY,
1025 BIODEGRADATION, BIOLOGICAL EFFECTS, CONTAMINATION, HYDROCARBONS , MARINE ORGANISMS, *CONFERENCE SUMMARY,
1039 BIODEGRADATION, ESTUARIES, MARSHES, SUBLETHAL EFFECTS, MARINE ORGANISMS, MICROORGANISMS, *PROCEEDINGS,
1046 BIODEGRADATION, BEAUFORT SEA, OIL SPILLS, DISPERSIONS, FATE, MEDITERRANEAN SEA,
1068 BIODEGRADATION, BACTERIA, WASTE OIL, DISPOSAL , SOIL, *BIODISPOSAL FARMING,
1069 BIODEGRADATION, BENTHOS, ARCTIC, CRUDE OIL, MICROORGANISMS, INVERTEBRATES, MORTALITY, *RECOLONIZATION,
1070 BIODEGRADATION, PETROLEUM PRODUCTS, MICROORGANISMS, PATENT, *NUTRIENTS,
1071 BIODEGRADATION, BACTERIA, MICROORGANISMS, WEATHERING, METULA SPILL, STRAIT OF MAGELLAN,
1072 BIODEGRADATION, BIOMASS, MICROORGANISMS, FUEL OIL, PH CONTROL, *DEVIATIONS, *ALKALI CONSUMPTION,
1073 BIODEGRADATION, MICROORGANISMS, *CARBON CYCLE,
1074 BIODEGRADATION, BACTERIA, MICROORGANISMS, FUNGI, YEASTS, HYDROCARBONS ,
1075 BIODEGRADATION, BACTERIA, DISTRIBUTION, HYDROCARBONS , JAPAN, *BISAN SETO,
1076 BIODEGRADATION, ACTIVATED SLUDGE, TOXICITY, WASTEWATERS, MARINE ORGANISMS, YEASTS, FOOD WEB,
1077 BIODEGRADATION, SLUDGE , REFINERIES, SOIL, DISPOSAL , INCINERATION, *LAND FARMING,
1078 BIODEGRADATION, BACTERIA, ARCTIC OCEAN, MICROORGANISMS, HYDROCARBONS ,
1079 BIODEGRADATION, ARCTIC, MICROORGANISMS, CRUDE OIL,
1080 BIODEGRADATION, CRUDE OIL, HYDROCARBONS , MICROORGANISMS, DISPERSANTS, TAR,
1081 BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS, SEAWATER,
1082 BIODEGRADATION, HYDROCARBONS , METABOLISM, CRUSTACEANS, *CALLINECTES SAPIDUS, POLYCHAETES, *NEREIS SP., *ARYL HYDROCARBON HYDROXYLASE,
1083 BIODEGRADATION, BACTERIA, MICROORGANISMS, HYDROCARBONS , YEASTS, FUNGI, *REVIEW,
1084 BIODEGRADATION, AROMATIC HYDROCARBONS, MARINE ORGANISMS, METABOLISM, OXIDATION, *ENZYME SYSTEMS,
1085 BIODEGRADATION, BACTERIA, HYDROCARBONS , GROWTH,
1086 BIODEGRADATION, BACTERIA, SPILL CLEANUP,
1087 BIODEGRADATION, SOIL, CRUDE OIL, *(NH4)2SO4, *NUTRIENTS, *AERATION,
1088 BIODEGRADATION, BACTERIA, HYDROCARBONS , MICROORGANISMS, YEASTS, FUNGI, SOIL,
1089 BIODEGRADATION, BACTERIA, FUNGI, MICROORGANISMS, SOIL, HYDROCARBONS ,
1090 BIODEGRADATION, BACTERIA, GASOLINE, GROUNDWATER, CONTAMINATION,
1091 BIODEGRADATION, MICROORGANISMS, *TUNDRA, NATURAL SEEPAGE, ALASKA,
1092 BIODEGRADATION, HYDROCARBONS , FUEL OIL, METABOLISM, LUBRICATING OIL, *PROCEEDINGS,
1093 BIODEGRADATION, FRESHWATER, ECOSYSTEMS, MICROORGANISMS, OIL SLICKS, *CONTINUOUS CULTURE,
1094 BIODEGRADATION, MICROORGANISMS, CARCINOGENS, SEAWATER, SEDIMENTS, CHESAPEAKE BAY, CRANKCASE OIL,
1101 BIODEGRADATION, WEATHERING, FATE, RECOVERY, *SYMPOSIUM SUMMARY,
1102 BIODEGRADATION, DISTRIBUTION, FATE, HYDROCARBONS , CHEMICAL ANALYSIS, SEDIMENTS, SEAWATER, *PROCEEDINGS,
1104 BIODEGRADATION, HYDROCARBONS , PAH, SOURCES, UPTAKE, RELEASE, MARINE ORGANISMS, FOOD WEB,
1105 BIODEGRADATION, BAYS, FUEL OIL, HYDROCARBONS , CHROMATOGRAPHY, FATE, SOURCE IDENTIFICATION, CANADA, *PENTACYCLIC TRITERPANES,

1106 BIODEGRADATION, AROMATIC HYDROCARBONS, SOURCES, DISTRIBUTION, FATE,
1113 BIODEGRADATION, AROMATIC HYDROCARBONS, SAMPLING, INTERTIDAL ZONE, MICROORGANISMS, YUGOSLAVIA,
1115 BIODEGRADATION, OIL SPILLS, EVAPORATION, SEAWATER, *KINETICS,
R118 BIODEGRADATION, HYDROCARBONS , GROUNDWATER, SEDIMENTS, CONTAMINATION, OIL FIELDS, MARSHES,
R126 BIODEGRADATION, MONITORING, FATE, TOXICITY, SOIL,
R127 BIODEGRADATION, BACTERIA, FUNGI, CRUDE OIL, MARSHES, ESTUARIES, SEDIMENTS,
R128 BIODEGRADATION, YEASTS, FUNGI, EMULSIFICATION, TOXICITY, GROWTH,
R129 BIODEGRADATION, MICROORGANISMS, BIOLOGICAL EFFECTS, COASTS, ICE, ALASKA,
R130 BIODEGRADATION, CONTAMINANTS, BIOLOGICAL EFFECTS, MICROORGANISMS, ESTUARIES, FOOD WEB, UPTAKE, NEW JERSEY,
R131 BIODEGRADATION, FATE, MICROORGANISMS, CRUDE OIL,
R132 BIODEGRADATION, BACTERIA, ANALYTICAL TECHNIQUES, MICROORGANISMS, CHEMICAL ANALYSIS,
R133 BIODEGRADATION, BACTERIA, CRUDE OIL, SEA SURFACE, SEDIMENTS, OCEANS, ESTUARIES, *WATER COLUMN,
R134 BIODEGRADATION, CRUDE OIL, MICROORGANISMS, INLAND, SOIL, SUBARCTIC REGIONS,
R136 BIODEGRADATION, SURFACTANTS, WASTEWATER TREATMENT, SPILL CLEANUP, *SOLUBILIZATION,
R141 BIODEGRADATION, FATE, MODELS, OIL SPILLS, DISPERSANTS, WEATHERING, EVAPORATION, *PREDICTION,
R145 BIODEGRADATION, MODELS, MARINE ORGANISMS, HYDROCARBONS , OIL SLICKS, FATE,
0753 BIOGENIC HYDROCARBONS, SOURCE IDENTIFICATION, HYDROCARBONS , SEDIMENTS, GC/MS,
0764 BIOGENIC HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS , SEDIMENTS, SEAWATER,
0772 BIOGENIC HYDROCARBONS, HYDROCARBONS , SEDIMENTS, CHRONIC EFFECTS, SOURCES, NARRAGANSETT BAY, *RHODE ISLAND SOUND,
1053 BIOGENIC HYDROCARBONS, BASELINE STUDIES, MARINE ORGANISMS, SEDIMENTS, DISTRIBUTION, MEXICO , *N-PARAFFINS,
1055 BIOGENIC HYDROCARBONS, SAMPLING, LAKES , PAH, CANADA,
R096 BIOGENIC HYDROCARBONS, ADSORPTION, HYDROCARBONS , SEDIMENTATION, ENVIRONMENTAL EFFECTS, ESTUARIES, MONITORING,
R140 BIOGENIC HYDROCARBONS, FATE, DISTRIBUTION, PETROCHEMICALS, SEDIMENTATION, OCEANS,
0711 BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, ACUTE EFFECTS, MARINE ORGANISMS, COASTS, FRANCE,
0754 BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY, MONITORING, SOURCES, *BIOLOGICAL TESTS,
0773 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, ACUTE EFFECTS, CHEMICAL ANALYSIS, TOXICITY, SUBLETHAL EFFECTS,
0885 BIOLOGICAL EFFECTS, OIL-WATER SEPARATION, LUBRICATING OIL, COST ANALYSIS,
0942 BIOLOGICAL EFFECTS, MARINE ORGANISMS, HYDROCARBONS , SEDIMENTS, CHRONIC EFFECTS, RECOVERY,
0946 BIOLOGICAL EFFECTS, BEHAVIOR, WSF, FUEL OIL, CRUSTACEANS, *CANCER IRRORATUS,
0954 BIOLOGICAL EFFECTS, CHRONIC EFFECTS, UPTAKE, INTERTIDAL ZONE, ECHINODERMS, WEATHERING, *GENERAL M.C. MEIGS SPILL,
0955 BIOLOGICAL EFFECTS, ALGAE, WSF, GROWTH, CRUDE OIL, FUEL OIL, FRESHWATER,
0956 BIOLOGICAL EFFECTS, CONTAMINATION, MOLLUSKS, *GENETIC STRUCTURE, *UROSALPINX CINEREA, BUZZARDS BAY,
0957 BIOLOGICAL EFFECTS, BIRDS, *SHETLAND ISLANDS, UK,
0960 BIOLOGICAL EFFECTS, BIODEGRADATION, BACTERIA, ESTUARIES, MARSHES, MICROORGANISMS,
0961 BIOLOGICAL EFFECTS, ALGAE, DISPERSANTS, TOXICITY, *CELL MEMBRANES, *NITELLA FLEXILIS,
0964 BIOLOGICAL EFFECTS, ALGAE, HYDROCARBONS , WSF, MARINE ORGANISMS, INVERTEBRATES, *PROCEEDINGS,
0965 BIOLOGICAL EFFECTS, MOLLUSKS, FUEL OIL, CHRONIC EFFECTS, UPTAKE, GROWTH, *CARBON FLUX, *MYA ARENARIA, CHEDABUCTO BAY,
0967 BIOLOGICAL EFFECTS, ALGAE, CRUDE OIL, DISPERSANTS, PHYTOPLANKTON, *COREXIT, *PRIMARY PRODUCTION,
0968 BIOLOGICAL EFFECTS, BACTERIA, HYDROCARBONS , *CO2 FIXATION,
0972 BIOLOGICAL EFFECTS, FUEL OIL, CONTAMINATION, MARSHES, RECOVERY, CRUSTACEANS, BUZZARDS BAY, *UCA PUGNAX,
0973 BIOLOGICAL EFFECTS, FISH, CONTAMINATION, *DIESEL 2 OIL, *BLENNIUS PAVO,
0976 BIOLOGICAL EFFECTS, TOXICITY, HYDROCARBONS , GROWTH, *MUSSELS,
0977 BIOLOGICAL EFFECTS, CRUDE OIL, *EKOFISK OIL, FISH, *LARVAE,
0978 BIOLOGICAL EFFECTS, FISH, UPTAKE, CRUDE OIL, SEDIMENTS, TOXICITY, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0982 BIOLOGICAL EFFECTS, CRANKCASE OIL, PAH, *MUTAGENIC ACTIVITY,
0983 BIOLOGICAL EFFECTS, CHRONIC EFFECTS, CRUSTACEANS, WSF, CRUDE OIL, GROWTH, *MOLTING, *MESIDOTEA ENTOMON,
0984 BIOLOGICAL EFFECTS, SOURCES, TANKERS, CARCINOGENS, BOOK REVIEW,
0992 BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, CRUDE OIL, MICROORGANISMS, SOIL,
0996 BIOLOGICAL EFFECTS, CONTAMINATION, FISH, RECOVERY, FLORIDA SPILL, BUZZARDS BAY, *FUNDULUS HETEROCLITUS,
0997 BIOLOGICAL EFFECTS, BIRDS, CONTAMINATION, MORTALITY, *EGGS, *HATCHABILITY,
0998 BIOLOGICAL EFFECTS, INTERTIDAL ZONE, BIOMASS, SEDIMENTS, HYDROCARBONS , CHEDABUCTO BAY,
1000 BIOLOGICAL EFFECTS, MOLLUSKS, METABOLISM, CRUDE OIL, FUEL OIL, FOOD WEB, *ENZYME ACTIVITY,
1017 BIOLOGICAL EFFECTS, RECOVERY, ECOSYSTEMS, FATE, INTERTIDAL ZONE, *PROCEEDINGS,
1021 BIOLOGICAL EFFECTS, COASTS, HABITATS, ENVIRONMENTAL EFFECTS, COASTAL ZONE MANAGEMENT, SPILL CLEANUP,

1022 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, RIVERS, WASTEWATERS, CONTAMINANTS, SOURCES,
1024 BIOLOGICAL EFFECTS, INTERTIDAL ZONE, SOURCES, SPILL CLEANUP, PACIFIC OCEAN,
1025 BIOLOGICAL EFFECTS, BIODEGRADATION, CONTAMINATION, HYDROCARBONS , MARINE ORGANISMS, *CONFERENCE SUMMARY,
1026 BIOLOGICAL EFFECTS, MARINE ORGANISMS, DETECTION, *REVIEW,
1029 BIOLOGICAL EFFECTS, ENVIRONMENTAL EFFECTS, SOURCES, FATE,
1032 BIOLOGICAL EFFECTS, BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL, COASTS, FRANCE,
1033 BIOLOGICAL EFFECTS, SOURCES, CONTAMINATION, OCEANS, PHYTOPLANKTON, *RATE OF INPUT,
1040 BIOLOGICAL EFFECTS, HYDROCARBONS , MARINE ORGANISMS, ECOSYSTEMS, FATE, UPTAKE, METABOLISM, *PROCEEDINGS,
1108 BIOLOGICAL EFFECTS, WEATHERING, SEDIMENTS, POLYCHAETES, *ARENICOLA MARINA,
1111 BIOLOGICAL EFFECTS, MARINE ORGANISMS, CONTAMINATION, OFFSHORE DRILLING, FATE, SHORELINES,
1166 BIOLOGICAL EFFECTS, BOOK REVIEW, *PROCEEDINGS,
1174 BIOLOGICAL EFFECTS, ARCTIC, POLLUTION PREVENTION, POLLUTION CONTROL, *RESEARCH PROPOSALS, *AMOP,
R061 BIOLOGICAL EFFECTS, BENTHOS, ANALYTICAL TECHNIQUES, SAMPLING, OIL SPILLS, BUZZARDS BAY, *X-RAY RADIOGRAPHY,
R088 BIOLOGICAL EFFECTS, BIOASSAY, DISPERSANTS, MARINE ORGANISMS, TOXICITY,
R094 BIOLOGICAL EFFECTS, BEACHES, BIRDS, CHRONIC EFFECTS, ALASKA,
R097 BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, ALGAE, CRUDE OIL, ZOOPLANKTON, *TUNDRA PONDS,
R100 BIOLOGICAL EFFECTS, BEHAVIOR, CRUDE OIL, HYDROCARBONS , INVERTEBRATES, FISH, DEVELOPMENT , GROWTH,
R102 BIOLOGICAL EFFECTS, CRUDE OIL, SEDIMENTS, PLANTS, MARSHES, *NITROGEN FLUX, *SPARTINA ALTERNIFLORA,
R103 BIOLOGICAL EFFECTS, MARINE ORGANISMS, FOOD WEB, COASTS, BIOINDICATORS, *MYTILUS EDULIS,
R108 BIOLOGICAL EFFECTS, BIOINDICATORS, WASTEWATERS, REFINERIES, MOLLUSKS, CRUSTACEANS, PACIFIC OCEAN,
R129 BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, COASTS, ICE, ALASKA,
R130 BIOLOGICAL EFFECTS, BIODEGRADATION, CONTAMINANTS, MICROORGANISMS, ESTUARIES, FOOD WEB, UPTAKE, NEW JERSEY,
0827 BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, REFINERIES, OXIDATION, *AERATION,
0998 BIOMASS, BIOLOGICAL EFFECTS, INTERTIDAL ZONE, SEDIMENTS, HYDROCARBONS , CHEDABUCTO BAY,
1010 BIOMASS, BENTHOS, RECOVERY, REFINERIES, WASTEWATER TREATMENT, CHRONIC EFFECTS, DISTRIBUTION, *RECOLONIZATION,
1072 BIOMASS, BIODEGRADATION, MICROORGANISMS, FUEL OIL, PH CONTROL, *DEVIATIONS, *ALKALI CONSUMPTION,
0715 BIRDS, OIL TERMINALS, STATISTICS, NORTH SEA, SCOTLAND,
0719 BIRDS, OIL TERMINALS, TANKERS, OIL SPILLS, OIL SLICKS, MORTALITY, *MILFORD HAVEN,
0940 BIRDS, MORTALITY, OIL SLICKS, UK,
0941 BIRDS, FUEL OIL, MORTALITY, *EMBRYOTOXICITY, *EGGS,
0947 BIRDS, ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINANTS,
0957 BIRDS, BIOLOGICAL EFFECTS, *SHETLAND ISLANDS, UK,
0997 BIRDS, BIOLOGICAL EFFECTS, CONTAMINATION, MORTALITY, *EGGS, *HATCHABILITY,
1003 BIRDS, AMOCO CADIZ SPILL, TORREY CANYON SPILL, RECOVERY, CONTAMINATION,
1004 BIRDS, BALTIC SEA, CONTAMINATION, MORTALITY, RECOVERY,
1005 BIRDS, API, RESTORATION, BOOK REVIEW,
1007 BIRDS, RESTORATION, CONSERVATION, OIL SPILLS, TORREY CANYON SPILL,
1009 BIRDS, RESTORATION, OIL SLICKS, MANUALS,
1056 BIRDS, SCOTLAND, EKOFISK BLOWOUT, *SEABIRD POPULATION STUDY,
1063 BIRDS, BASELINE STUDIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, MICROORGANISMS, ALASKA,
1164 BIRDS, PLATFORMS, *FIELD OBSERVATIONS,
R076 BIRDS, DISPERSANTS, SPILL REMOVAL, MANUALS, POLLUTION PREVENTION, SAFETY, ENVIRONMENTAL PROTECTION,
R094 BIRDS, BIOLOGICAL EFFECTS, BEACHES, CHRONIC EFFECTS, ALASKA,
R106 BIRDS, SUBLETHAL EFFECTS, TOXICITY, GUIDELINES,
R114 BIRDS, HABITATS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OIL TRANSPORT, PIPELINES, ALASKA, *WETLAND RESOURCES,
0785 BLACK SEA, SPILL REMOVAL, ICE, HARBORS, EQUIPMENT,
1054 BLM, BASELINE STUDIES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, *EDITORIAL,
1062 BLM, BEAUFORT SEA, OCS, ENVIRONMENTAL EFFECTS, CRUDE OIL, OFFSHORE DEVELOPMENT, GULF OF ALASKA,
1066 BLM, OCS, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, DEVELOPMENT , *ENVIRONMENTAL STUDIES PROGRAM,
0740 BOOK REVIEW, REMOTE SENSING, FOSSIL FUELS, DEVELOPMENT , MONITORING, ENVIRONMENTAL EFFECTS,
0984 BOOK REVIEW, BIOLOGICAL EFFECTS, SOURCES, TANKERS, CARCINOGENS,
1005 BOOK REVIEW, BIRDS, API, RESTORATION,
1034 BOOK REVIEW, WATER QUALITY, SOURCES, INDUSTRIES, LAKES , OCEANS,
1166 BOOK REVIEW, BIOLOGICAL EFFECTS, *PROCEEDINGS,
0783 BOOMS, SPILL CONTAINMENT, PRODUCT INFORMATION, *VATOR OY CO,
0802 BOOMS, OIL SPILLS, SPILL CLEANUP, SKIMMERS, LEGISLATION, POLLUTION PREVENTION,
0806 BOOMS, SPILL CONTAINMENT, SPILL REMOVAL, SHIPS, EQUIPMENT, PATENT,
0817 BOOMS, ICE, SPILL CLEANUP, SPILL CONTAINMENT, DESIGN-ENGINEERING,

R073 BOOMS, SPILL CLEANUP, SKIMMERS, SORBENTS, EVAPORATION, *FOAMS, *GELS,
1008 BOUCHARD 65 SPILL, BENTHOS, FUEL OIL, INVERTEBRATES, RESTORATION, RECOVERY, MARSHES, BUZZARDS BAY,
0769 BUZZARDS BAY, AROMATIC HYDROCARBONS, FUEL OIL, SEDIMENTS, MARSHES, CHROMATOGRAPHY, SPECTROMETRY,
0956 BUZZARDS BAY, BIOLOGICAL EFFECTS, CONTAMINATION, MOLLUSKS, *GENETIC STRUCTURE, *UROSALPINX CINEREA,
0972 BUZZARDS BAY, BIOLOGICAL EFFECTS, FUEL OIL, CONTAMINATION, MARSHES, RECOVERY, CRUSTACEANS, *UCA PUGNAX,
0990 BUZZARDS BAY, BENTHOS, FLORIDA SPILL, MARINE ORGANISMS, INTERTIDAL ZONE, SEDIMENTS, STATISTICAL ANALYSIS,
0996 BUZZARDS BAY, BIOLOGICAL EFFECTS, CONTAMINATION, FISH, RECOVERY, FLORIDA SPILL, *FUNDULUS HETEROCLITUS,
1008 BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS, FUEL OIL, INVERTEBRATES, RESTORATION, RECOVERY, MARSHES,
R061 BUZZARDS BAY, BIOLOGICAL EFFECTS, BENTHOS, ANALYTICAL TECHNIQUES, SAMPLING, OIL SPILLS, *X-RAY RADIOGRAPHY,
R058 CALIFORNIA, MONITORING, GASOLINE, WATER QUALITY, GC/MS, LAKES , *RECREATIONAL BOATING,
0718 CANADA, STATISTICS, OIL SPILLS, PETROLEUM PRODUCTS, *NATES DATABASE,
0792 CANADA, SPILL DISPOSAL, INCINERATION, EQUIPMENT,
0807 CANADA, SPILL CLEANUP, ICE, RIVERS, EQUIPMENT, SKIMMERS,
0843 CANADA, WASTEWATERS, REFINERIES, POLLUTION PREVENTION, OIL INDUSTRY, REGULATIONS, GUIDELINES,
0923 CANADA, CONTINGENCY PLANNING, SPILL CLEANUP, GOVERNMENT AGENCIES, LEGISLATION, *ONTARIO,
0933 CANADA, POLLUTION CONTROL, DISPERSANTS, EQUIPMENT, SPILL CLEANUP, *DISPERSANT TECHNOLOGY,
1052 CANADA, BASELINE STUDIES, ARCTIC OCEAN, COASTS, MARINE MAMMALS,
1055 CANADA, BIOGENIC HYDROCARBONS, SAMPLING, LAKES , PAH,
1105 CANADA, BIODEGRADATION, BAYS, FUEL OIL, HYDROCARBONS , CHROMATOGRAPHY, FATE, SOURCE IDENTIFICATION, *PENTACYCLIC TRITERPANES,
1151 CANADA, BIBLIOGRAPHIES, DISPERSANTS, FATE, ENVIRONMENTAL EFFECTS,
1167 CANADA, ENVIRONMENTAL EFFECTS, OIL TERMINALS, PIPELINES,
0872 CARCINOGENS, AROMATIC HYDROCARBONS, DISPOSAL , WASTE OIL, LUBRICATING OIL, REFINING, RECLAMATION,
0971 CARCINOGENS, FATE, DISTRIBUTION, PAH, HYDROCARBONS , METABOLISM, MARINE ORGANISMS, *PROCEEDINGS, *NEOPLASIA,
0984 CARCINOGENS, BOOK REVIEW, BIOLOGICAL EFFECTS, SOURCES, TANKERS,
1094 CARCINOGENS, BIODEGRADATION, MICROORGANISMS, SEAWATER, SEDIMENTS, CHESAPEAKE BAY, CRANKCASE OIL,
1110 CARCINOGENS, PAH, CONTAMINANTS, SOURCES, DISTRIBUTION, HEALTH HAZARDS, METABOLISM,
R091 CARCINOGENS, AROMATIC HYDROCARBONS, MARINE ORGANISMS, HEALTH HAZARDS, TOXICITY, *PNA,
0965 CHEDABUCTO BAY, BIOLOGICAL EFFECTS, MOLLUSKS, FUEL OIL, CHRONIC EFFECTS, UPTAKE, GROWTH, *CARBON FLUX, *MYA ARENARIA,
0998 CHEDABUCTO BAY, BIOMASS, BIOLOGICAL EFFECTS, INTERTIDAL ZONE, SEDIMENTS, HYDROCARBONS ,
1018 CHEDABUCTO BAY, BIODEGRADATION, BACTERIA, RECOVERY, MICROORGANISMS, SEDIMENTS, DISTRIBUTION,
1109 CHEDABUCTO BAY, FATE, SEDIMENTS, FUEL OIL, INTERTIDAL ZONE, *ARROW SPILL,
0728 CHEMICAL ANALYSIS, MONITORING, REMOTE SENSING, *FLUOROMETRY,
0729 CHEMICAL ANALYSIS, MONITORING, UPTAKE, PATENT, *FLUOROMETRY,
0730 CHEMICAL ANALYSIS, MONITORING, EQUIPMENT, *INFRARED DETECTION ,
0742 CHEMICAL ANALYSIS, BENTHOS, AROMATIC HYDROCARBONS, SAMPLING, MARINE ORGANISMS, CRUDE OIL, NORWAY,
0750 CHEMICAL ANALYSIS, PAH, CHROMATOGRAPHY, GULF OF MEXICO, *CRASSOSTREA VIRGINICA,
0751 CHEMICAL ANALYSIS, HYDROCARBONS , CHROMATOGRAPHY, SPECTROMETRY, MARINE ORGANISMS,
0752 CHEMICAL ANALYSIS, SAMPLING, CHROMATOGRAPHY, HYDROCARBONS , CONTAMINATION, *TRACE LEVELS,
0756 CHEMICAL ANALYSIS, SEAWATER, HYDROCARBONS ,
0757 CHEMICAL ANALYSIS, CHROMATOGRAPHY, PAH, WATER QUALITY,
0759 CHEMICAL ANALYSIS, DETECTION, CRUDE OIL, WASTEWATERS, *SPECTROFLUOROMETRY,
0760 CHEMICAL ANALYSIS, DETECTION, WASTEWATERS, SURFACTANTS, EXTRACTION, *MEASUREMENT ERROR,
0762 CHEMICAL ANALYSIS, EKOFISK BLOWOUT, FATE, SEDIMENTS, FISH,
0763 CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, DETECTION, SEAWATER,
0764 CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SAMPLING, HYDROCARBONS , SEDIMENTS, SEAWATER,
0765 CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, CRUDE OIL, PETROLEUM PRODUCTS, *GRAVIMETRY,
0767 CHEMICAL ANALYSIS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, WASTEWATERS,
0768 CHEMICAL ANALYSIS, ADSORPTION, EXTRACTION, CONTAMINANTS, *MACRORETICULAR RESINS,
0770 CHEMICAL ANALYSIS, PRODUCT INFORMATION, *TELEDYNE ANALYTICAL INSTRUMENTS,
0773 CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, ACUTE EFFECTS, TOXICITY, SUBLETHAL EFFECTS,
0774 CHEMICAL ANALYSIS, ALGAE, WSF, FUEL OIL, PHYTOPLANKTON, TOXICITY, GROWTH,
0775 CHEMICAL ANALYSIS, SPECTROMETRY, EXTRACTION, WASTEWATERS,
0779 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL, FUEL OIL, CHROMATOGRAPHY,
0782 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SAMPLING, MANUALS, USCG, SAFETY, WEATHERING,

0950 CHEMICAL ANALYSIS, BACTERIA, ALGAE, TOXICITY, CHEMICAL EFFECTS, *TGK VALUES,
1002 CHEMICAL ANALYSIS, TA , SOIL, *TRACE METALS,
1102 CHEMICAL ANALYSIS, BIODEGRADATION, DISTRIBUTION, FATE, HYDROCARBONS , SEDIMENTS, SEAWATER, *PROCEEDINGS,
1112 CHEMICAL ANALYSIS, FATE, WEATHERING, SEDIMENTS, SAMPLING, MAINE, *MYA ARENARIA,
R066 CHEMICAL ANALYSIS, CRUDE OIL, SOLUBILITY, SPECTROMETRY, *MARKER COMPOUNDS, *SRM,
R067 CHEMICAL ANALYSIS, HYDROCARBONS , CONTAMINANTS, OXIDATION, SEDIMENTS, UPTAKE, CRANKCASE OIL, DELAWARE, *CHARACTERIZATION,
R068 CHEMICAL ANALYSIS, HYDROCARBONS , OCEANS, MARINE ORGANISMS, *TRACE GASES,
R132 CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, ANALYTICAL TECHNIQUES, MICROORGANISMS,
R142 CHEMICAL ANALYSIS, BENTHOS, HYDROCARBONS , SEAWATER, SEDIMENTS, FATE, SARGASSO SEA, *TRANSPORT ,
0950 CHEMICAL EFFECTS, CHEMICAL ANALYSIS, BACTERIA, ALGAE, TOXICITY, *TGK VALUES,
R085 CHEMICAL EFFECTS, OIL DISCHARGES, SOURCES, POLLUTION CONTROL, *MILITARY INSTALLATIONS,
R111 CHEMICAL EFFECTS, ACUTE EFFECTS, CRUDE OIL, MARSHES, ESTUARIES, FOOD WEB, RECOVERY,
R137 CHEMICAL EFFECTS, OIL SLICKS, DISPERSIONS, MODELS, PHYSICAL EFFECTS, EMULSIONS, *WAVE ACTION,
R139 CHEMICAL EFFECTS, HYDROCARBONS , SOLUBILITY, SEAWATER, USN,
1094 CHESAPEAKE BAY, CARCINOGENS, BIODEGRADATION, MICROORGANISMS, SEAWATER, SEDIMENTS, CRANKCASE OIL,
0741 CHROMATOGRAPHY, ARGO MERCHANT SPILL, SAMPLING, SEDIMENTS, CRUDE OIL, *FIELD METHOD,
0747 CHROMATOGRAPHY, BENTHOS, HYDROCARBONS , SEDIMENTS, INTERTIDAL ZONE, RELEASE, *RECRUITMENT,
0749 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, PAH, DISTILLATION, SPECTROMETRY,
0750 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, GULF OF MEXICO, *CRASSOSTREA VIRGINICA,
0751 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS , SPECTROMETRY, MARINE ORGANISMS,
0752 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS , CONTAMINATION, *TRACE LEVELS,
0757 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, WATER QUALITY,
0758 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, CRUDE OIL, OIL SHALE, *COAL OIL,
0765 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, CRUDE OIL, PETROLEUM PRODUCTS, *GRAVIMETRY,
0767 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, WASTEWATERS,
0769 CHROMATOGRAPHY, BUZZARDS BAY, AROMATIC HYDROCARBONS, FUEL OIL, SEDIMENTS, MARSHES, SPECTROMETRY,
0771 CHROMATOGRAPHY, PAH, *SURVEY, *HPLC,
0777 CHROMATOGRAPHY, *UV ABSORPTION, HYDROCARBONS , MONITORING, MARINE ORGANISMS,
0779 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL, FUEL OIL,
0781 CHROMATOGRAPHY, SOURCE IDENTIFICATION, CRUDE OIL, WEATHERING, SAMPLING,
0989 CHROMATOGRAPHY, AROMATIC HYDROCARBONS, METABOLISM, PAH, FISH, *ONCORHYNCHUS KISUTCH,
1105 CHROMATOGRAPHY, CANADA, BIODEGRADATION, BAYS, FUEL OIL, HYDROCARBONS , FATE, SOURCE IDENTIFICATION, *PENTACYCLIC TRITERPANES,
0772 CHRONIC EFFECTS, BIOGENIC HYDROCARBONS, HYDROCARBONS , SEDIMENTS, SOURCES, NARRAGANSETT BAY, *RHODE ISLAND SOUND,
0942 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, HYDROCARBONS , SEDIMENTS, RECOVERY,
0948 CHRONIC EFFECTS, HYDROCARBONS , MOLLUSKS, UPTAKE, RELEASE, RIVERS, *MERCENARIA MERCENARIA,
0954 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, UPTAKE, INTERTIDAL ZONE, ECHINODERMS, WEATHERING, *GENERAL M.C. MEIGS SPILL,
0965 CHRONIC EFFECTS, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, MOLLUSKS, FUEL OIL, UPTAKE, GROWTH, *CARBON FLUX, *MYA ARENARIA,
0966 CHRONIC EFFECTS, OIL SPILLS, MOLLUSKS, *CLAMS, MORTALITY, SEDIMENTS, MAINE,
0981 CHRONIC EFFECTS, SUBLETHAL EFFECTS, FISH, CRUDE OIL, *TISSUES, *TAUTOGOLABRUS ADSPERSUS,
0983 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, CRUSTACEANS, WSF, CRUDE OIL, GROWTH, *MOLTING, *MESIDOTEA ENTOMON,
1010 CHRONIC EFFECTS, BIOMASS, BENTHOS, RECOVERY, REFINERIES, WASTEWATER TREATMENT, DISTRIBUTION, *RECOLONIZATION,
1012 CHRONIC EFFECTS, INTERTIDAL ZONE, RECOVERY, ECOSYSTEMS, *SYMPOSIUM SUMMARY,
1014 CHRONIC EFFECTS, BALTIC SEA, RECOVERY, MARINE ORGANISMS, INTERTIDAL ZONE, *FUCUS VESICULOSUS, *IRINI SPILL,
R090 CHRONIC EFFECTS, MARSHES, FISH, INVERTEBRATES, CONTAMINATION, BIOINDICATORS,
R094 CHRONIC EFFECTS, BIRDS, BIOLOGICAL EFFECTS, BEACHES, ALASKA,
R105 CHRONIC EFFECTS, HYDROCARBONS , FISH, METABOLISM,
R107 CHRONIC EFFECTS, MOLLUSKS, NATURAL SEEPAGE, SEDIMENTS, INTERTIDAL ZONE, SAMPLING,
0832 COALESCENCE, WASTEWATER TREATMENT, EMULSIONS, LUBRICATING OIL, PH CONTROL,
0835 COALESCENCE, WASTEWATER TREATMENT, EMULSIONS, PATENT, *DETERGENT-OIL MIXTURES,
0840 COALESCENCE, BALLAST , OIL-WATER SEPARATION, FILTRATION , GRAVITY SEPARATION, PATENT, *DEWAXING UNIT,
0857 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
0883 COALESCENCE, OIL-WATER SEPARATION, WASTEWATER TREATMENT, REFINERIES, *FIBROUS BEDS,
0888 COALESCENCE, OIL-WATER SEPARATION, EQUIPMENT, GRAVITY SEPARATION, PRODUCT INFORMATION,
0889 COALESCENCE, OIL-WATER SEPARATION, EPA, REUSE, REGULATIONS, PRODUCT INFORMATION,
1021 COASTAL ZONE MANAGEMENT, BIOLOGICAL EFFECTS, COASTS, HABITATS, ENVIRONMENTAL EFFECTS, SPILL CLEANUP,

1125 COASTAL ZONE MANAGEMENT, API, STATE GOVERNMENTS, RESOURCE MANAGEMENT,
1128 COASTAL ZONE MANAGEMENT, LEGISLATION, REGULATIONS, GOVERNMENT AGENCIES, STATE GOVERNMENTS, PORTS , TANKERS, OCS,
1142 COASTAL ZONE MANAGEMENT, GUIDELINES, MANUALS, INDUSTRIES, CONSERVATION,
0711 COASTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, ACUTE EFFECTS, MARINE ORGANISMS, FRANCE,
0722 COASTS, BEACH CLEANUP, AMOCO CADIZ SPILL, ENVIRONMENTAL EFFECTS, MARSHES, MARINE ORGANISMS, FISHERIES, FRANCE,
0723 COASTS, STATISTICS, IRELAND,
0737 COASTS, REMOTE SENSING, DETECTION, MONITORING, ESTUARIES,
0877 COASTS, WASTEWATERS, HYDROCARBONS , FATE, SEDIMENTATION, RIVERS, ESTUARIES, NARRAGANSETT BAY, *PROVIDENCE RIVER,
0924 COASTS, CONTINGENCY PLANNING, WILDLIFE, *BRITISH ISLES,
1021 COASTS, COASTAL ZONE MANAGEMENT, BIOLOGICAL EFFECTS, HABITATS, ENVIRONMENTAL EFFECTS, SPILL CLEANUP,
1032 COASTS, BIOLOGICAL EFFECTS, BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL, FRANCE,
1037 COASTS, ENVIRONMENTAL EFFECTS, OIL SPILLS, OCS, LEGISLATION,
1052 COASTS, CANADA, BASELINE STUDIES, ARCTIC OCEAN, MARINE MAMMALS,
1137 COASTS, RESOURCE MANAGEMENT, POLLUTION PREVENTION, ISRAEL, MEDITERRANEAN SEA,
1139 COASTS, OIL SPILLS, ONSHORE IMPACTS, GUIDELINES, *SHORELINE TYPE CLASSIFICATION, *CASE STUDIES,
1153 COASTS, BIBLIOGRAPHIES, ESTUARIES, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, DEVELOPMENT ,
R103 COASTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, FOOD WEB, BIOINDICATORS, *MYTILUS EDULIS,
R110 COASTS, BEHAVIOR, BEACH CLEANUP, AMOCO CADIZ SPILL, DISPERSIONS, SPILL REMOVAL, SEDIMENTATION,
R120 COASTS, OIL INDUSTRY, DEVELOPMENT , LOUISIANA,
R129 COASTS, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, ICE, ALASKA,
R143 COASTS, MODELS, OIL SPILLS, FATE, NOAA, *SPILL TRAJECTORY,
R144 COASTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, *VULNERABILITY, *KODIAK ISLAND,
0710 COMPENSATION, OIL SPILLS, FISH, MORTALITY, *ADRIAN MAERSK SPILL, *HONG KONG,
1144 COMPENSATION, AMOCO CADIZ SPILL, SPILL CLEANUP, *CRISTAL,
1150 COMPENSATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, US, POLLUTION PREVENTION, LIABILITY, CONTINGENCY PLANNING,
0855 CONSERVATION, WASTEWATER TREATMENT, REFINERIES, REUSE, OXIDATION, *BIOOXIDATION,
1007 CONSERVATION, BIRDS, RESTORATION, OIL SPILLS, TORREY CANYON SPILL,
1020 CONSERVATION, OCEANS, ENVIRONMENTAL DETERIORATION, RESOURCE MANAGEMENT, RECOVERY,
1142 CONSERVATION, GUIDELINES, MANUALS, COASTAL ZONE MANAGEMENT, INDUSTRIES,
0768 CONTAMINANTS, CHEMICAL ANALYSIS, ADSORPTION, EXTRACTION, *MACRORETICULAR RESINS,
0829 CONTAMINANTS, WASTEWATER TREATMENT, REFINERIES, RECYCLING,
0878 CONTAMINANTS, WASTEWATER TREATMENT, HYDROCARBONS , PAH, FLOCCULATION,
0881 CONTAMINANTS, OIL-WATER SEPARATION, FILTRATION , FRESHWATER, PATENT,
0943 CONTAMINANTS, METABOLISM, MARINE ORGANISMS, VERTEBRATES , INVERTEBRATES, *BIOTRANSFORMATIONS,
0947 CONTAMINANTS, BIRDS, ESTUARIES, ENVIRONMENTAL EFFECTS,
0949 CONTAMINANTS, MORTALITY, CRUSTACEANS, MARINE ORGANISMS, *LETHAL CONCENTRATION, *DAPHNIA MAGNA,
1022 CONTAMINANTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, RIVERS, WASTEWATERS, SOURCES,
1038 CONTAMINANTS, CRUDE OIL, WASTE OIL, PETROLEUM PRODUCTS, DISPOSAL , HEALTH HAZARDS, *TRACE METALS, *ASPHALT,
1041 CONTAMINANTS, CRUDE OIL, WASTE OIL, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, HEALTH HAZARDS, *TRACE METALS,
1107 CONTAMINANTS, FATE, MODELS, FOSSIL FUELS, SEDIMENTS, ESTUARIES,
1110 CONTAMINANTS, CARCINOGENS, PAH, SOURCES, DISTRIBUTION, HEALTH HAZARDS, METABOLISM,
1118 CONTAMINANTS, SOURCES, HYDROCARBONS , UPTAKE, MARINE ORGANISMS,
1163 CONTAMINANTS, FUELS , ENVIRONMENTAL DETERIORATION,
1169 CONTAMINANTS, BEHAVIOR, ANALYTICAL TECHNIQUES, FISH, TOXICITY,
R064 CONTAMINANTS, ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, TOXICITY, SAMPLING,
R067 CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS , OXIDATION, SEDIMENTS, UPTAKE, CRANKCASE OIL, DELAWARE, *CHARACTERIZATION,
R081 CONTAMINANTS, ANIMALS, WASTEWATERS, TOXICITY, HEALTH HAZARDS, PAH,
R099 CONTAMINANTS, BACTERIA, CRUDE OIL, SEAWATER, SUBLETHAL EFFECTS, MICROORGANISMS, *CHEMOTAXIS,
R104 CONTAMINANTS, MARINE ORGANISMS, MOLLUSKS, HYDROCARBONS , *TUMORS,
R119 CONTAMINANTS, OIL FIELDS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, GULF OF MEXICO,
R130 CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, ESTUARIES, FOOD WEB, UPTAKE, NEW JERSEY,
0712 CONTAMINATION, OIL SPILLS, POLLUTION CONTROL, MEDITERRANEAN SEA,
0714 CONTAMINATION, ARGENTINA, ENVIRONMENTAL DETERIORATION,
0745 CONTAMINATION, ANALYTICAL TECHNIQUES, SAMPLING, *NISKIN BOTTLES,
0752 CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS , *TRACE LEVELS,
0847 CONTAMINATION, WASTEWATER TREATMENT, PH CONTROL, REFINERIES, HYDROCARBONS , *COAGULATION,
0956 CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, MOLLUSKS, *GENETIC STRUCTURE, *UROSALPINX CINEREA,

0972 CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, FUEL OIL, MARSHES, RECOVERY, CRUSTACEANS, *UCA PUGNAX,
0973 CONTAMINATION, BIOLOGICAL EFFECTS, FISH, *DIESEL 2 OIL, *BLENNIUS PAVO,
0996 CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, FISH, RECOVERY, FLORIDA SPILL, *FUNDULUS HETEROCLITUS,
0997 CONTAMINATION, BIRDS, BIOLOGICAL EFFECTS, MORTALITY, *EGGS, *HATCHABILITY,
1001 CONTAMINATION, SUBLETHAL EFFECTS, HYDROCARBONS ,
1003 CONTAMINATION, BIRDS, AMOCO CADIZ SPILL, TORREY CANYON SPILL, RECOVERY,
1004 CONTAMINATION, BIRDS, BALTIC SEA, MORTALITY, RECOVERY,
1015 CONTAMINATION, ANTARCTICA, RECOVERY, STATISTICAL ANALYSIS, FUEL OIL,
1025 CONTAMINATION, BIOLOGICAL EFFECTS, BIODEGRADATION, HYDROCARBONS , MARINE ORGANISMS, *CONFERENCE SUMMARY,
1028 CONTAMINATION, BEACHES, SEAWATER, SOIL, HYDROCARBONS , PETROLEUM PRODUCTS, USSR,
1033 CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, OCEANS, PHYTOPLANKTON, *RATE OF INPUT,
1090 CONTAMINATION, BIODEGRADATION, BACTERIA, GASOLINE, GROUNDWATER,
1111 CONTAMINATION, BIOLOGICAL EFFECTS, MARINE ORGANISMS, OFFSHORE DRILLING, FATE, SHORELINES,
1160 CONTAMINATION, BIOINDICATORS, SUBLETHAL EFFECTS, *TELEMEDIATORS,
1161 CONTAMINATION, HYDROCARBONS , WATER QUALITY, GROUNDWATER, *REVIEW,
R060 CONTAMINATION, SAMPLING, SOLID WASTES, OIL INDUSTRY, GROUNDWATER, *LEACHING TEST,
R090 CONTAMINATION, CHRONIC EFFECTS, MARSHES, FISH, INVERTEBRATES, BIOINDICATORS,
R116 CONTAMINATION, BIODEGRADATION, HYDROCARBONS , GROUNDWATER, SEDIMENTS, OIL FIELDS, MARSHES,
R121 CONTAMINATION, ANALYTICAL TECHNIQUES, RESOURCE MANAGEMENT, DRILLING , GROUNDWATER, ECONOMIC EFFECTS, *ENHANCED OIL RECOVERY , *WATER RESOURCES,
0922 CONTINGENCY PLANNING, TANKERS, OIL SPILLS, ENVIRONMENTAL PROTECTION, SAFETY,
0923 CONTINGENCY PLANNING, CANADA, SPILL CLEANUP, GOVERNMENT AGENCIES, LEGISLATION, *ONTARIO,
0924 CONTINGENCY PLANNING, COASTS, WILDLIFE, *BRITISH ISLES,
0926 CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL SPILLS, *HONG KONG,
0928 CONTINGENCY PLANNING, OIL TRANSFER, OIL SPILLS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, DELAWARE BAY,
1150 CONTINGENCY PLANNING, COMPENSATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, US, POLLUTION PREVENTION, LIABILITY,
R101 CORAL REEFS, HYDROCARBONS , *DRILLING MUD, UPTAKE, RELEASE, GROWTH, SEDIMENTATION, FOOD WEB,
0885 COST ANALYSIS, BIOLOGICAL EFFECTS, OIL-WATER SEPARATION, LUBRICATING OIL,
R148 COST ANALYSIS, API, ENVIRONMENTAL PROTECTION, REGULATIONS,
R149 COST ANALYSIS, API, MODELS, GUIDELINES, STATISTICAL ANALYSIS, REFINERIES, WASTEWATERS, EPA,
R150 COST ANALYSIS, API, ENVIRONMENTAL PROTECTION,
0912 CRANKCASE OIL, WASTE OIL, RECYCLING, REUSE, INDUSTRIES, LEGISLATION, *PROCEEDINGS,
0919 CRANKCASE OIL, WASTE OIL TREATMENT, PATENT, EXTRACTION, RECLAMATION,
0982 CRANKCASE OIL, BIOLOGICAL EFFECTS, PAH, *MUTAGENIC ACTIVITY,
1094 CRANKCASE OIL, CHESAPEAKE BAY, CARCINOGENS, BIODEGRADATION, MICROORGANISMS, SEAWATER, SEDIMENTS,
R067 CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS , OXIDATION, SEDIMENTS, UPTAKE, DELAWARE, *CHARACTERIZATION,
0741 CRUDE OIL, CHROMATOGRAPHY, ARGO MERCHANT SPILL, SAMPLING, SEDIMENTS, *FIELD METHOD,
0742 CRUDE OIL, CHEMICAL ANALYSIS, BENTHOS, AROMATIC HYDROCARBONS, SAMPLING, MARINE ORGANISMS, NORWAY,
0758 CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, OIL SHALE, *COAL OIL,
0759 CRUDE OIL, CHEMICAL ANALYSIS, DETECTION, WASTEWATERS, *SPECTROFLUOROMETRY,
0765 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, PETROLEUM PRODUCTS, *GRAVIMETRY,
0779 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, FUEL OIL.
0781 CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION, WEATHERING, SAMPLING,
0812 CRUDE OIL, SPILL REMOVAL, EMULSIFICATION, DECOMPOSITION, YEAST, PATENT, *RICE BRAN,
0944 CRUDE OIL, BIOASSAY, AROMATIC HYDROCARBONS, ACUTE EFFECTS, TOXICITY, *MORONE SAXATILIS, *CRANGON FRANCISCORUM,
0953 CRUDE OIL, BACTERIA, TOXICITY, WSF, HYDROCARBONS , WASTE OIL, MOLLUSKS, SUBLETHAL EFFECTS, MORTALITY,
0955 CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, WSF, GROWTH, FUEL OIL, FRESHWATER,
0959 CRUDE OIL, CRUSTACEANS, WSF, FUEL OIL, TOXICITY, MORTALITY, *LARVAE,
0967 CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, DISPERSANTS, PHYTOPLANKTON, *COREXIT, *PRIMARY PRODUCTION,
0969 CRUDE OIL, BEHAVIOR, SUBLETHAL EFFECTS, WSF, GROWTH, *FEEDING RATES, *MERCENARIA MERCENARIA,
0977 CRUDE OIL, BIOLOGICAL EFFECTS, *EKOFISK OIL, FISH, *LARVAE,
0978 CRUDE OIL, BIOLOGICAL EFFECTS, FISH, UPTAKE, SEDIMENTS, TOXICITY, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0981 CRUDE OIL, CHRONIC EFFECTS, SUBLETHAL EFFECTS, FISH, *TISSUES, *TAUTOGOLABRUS ADSPERSUS,
0983 CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, CRUSTACEANS, WSF, GROWTH, *MOLTING, *MESIDOTEA ENTOMON,

0985 CRUDE OIL, BIOASSAY, ACUTE EFFECTS, FISH, MORTALITY, GROWTH, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
0986 CRUDE OIL, UPTAKE, HYDROCARBONS , PAH, INVERTEBRATES, SEDIMENTS, PRUDHOE BAY,
0987 CRUDE OIL, UPTAKE, *NAPHTHALENES, SEDIMENTS, MOLLUSKS, PRUDHOE BAY, *MACOMA INQUINATA,
0991 CRUDE OIL, ARCTIC, ACUTE EFFECTS, DISPERSANTS, TOXICITY, CRUSTACEANS, MORTALITY, *COREXIT 9527,
0992 CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, MICROORGANISMS, SOIL,
0999 CRUDE OIL, DISPERSANTS, TOXICITY, SEAWATER, PHYTOPLANKTON, *CARBON FIXATION, *COREXIT 9527,
1000 CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, METABOLISM, FUEL OIL, FOOD WEB, *ENZYME ACTIVITY,
1027 CRUDE OIL, ADSORPTION, ABSORPTION, SEDIMENTS, MOLLUSKS, UPTAKE, *OYSTERS,
1038 CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, DISPOSAL , HEALTH HAZARDS, *TRACE METALS, *ASPHALT,
1041 CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, HEALTH HAZARDS, *TRACE METALS,
1058 CRUDE OIL, EIS, STORAGE, FEA, LOUISIANA, *SALT DOME, *STRATEGIC PETROLEUM RESERVE,
1062 CRUDE OIL, BLM, BEAUFORT SEA, OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, GULF OF ALASKA,
1069 CRUDE OIL, BIODEGRADATION, BENTHOS, ARCTIC, MICROORGANISMS, INVERTEBRATES, MORTALITY, *RECOLONIZATION,
1079 CRUDE OIL, BIODEGRADATION, ARCTIC, MICROORGANISMS,
1080 CRUDE OIL, BIODEGRADATION, HYDROCARBONS , MICROORGANISMS, DISPERSANTS, TAR,
1087 CRUDE OIL, BIODEGRADATION, SOIL, *(NH4)2SO4, *NUTRIENTS, *AERATION,
1097 CRUDE OIL, PETROLEUM PRODUCTS, FUELS , EVAPORATION, MODELS, *EQUATIONS,
1099 CRUDE OIL, OIL SLICKS, SPREADING, MOVEMENT, EVAPORATION, LAKES ,
1117 CRUDE OIL, PAH, SEDIMENTS, SOURCES, ESTUARIES, UK,
R066 CRUDE OIL, CHEMICAL ANALYSIS, SOLUBILITY, SPECTROMETRY, *MARKER COMPOUNDS, *SRM,
R097 CRUDE OIL, BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, ALGAE, ZOOPLANKTON, *TUNDRA PONDS,
R098 CRUDE OIL, ARCTIC, FATE, ENVIRONMENTAL EFFECTS, DECOMPOSITION, PLANTS, *TUNDRA,
R099 CRUDE OIL, CONTAMINANTS, BACTERIA, SEAWATER, SUBLETHAL EFFECTS, MICROORGANISMS, *CHEMOTAXIS,
R100 CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, HYDROCARBONS , INVERTEBRATES, FISH, DEVELOPMENT , GROWTH,
R102 CRUDE OIL, BIOLOGICAL EFFECTS, SEDIMENTS, PLANTS, MARSHES, *NITROGEN FLUX, *SPARTINA ALTERNIFLORA,
R111 CRUDE OIL, CHEMICAL EFFECTS, ACUTE EFFECTS, MARSHES, ESTUARIES, FOOD WEB, RECOVERY,
R127 CRUDE OIL, BIODEGRADATION, BACTERIA, FUNGI, MARSHES, ESTUARIES, SEDIMENTS,
R131 CRUDE OIL, BIODEGRADATION, FATE, MICROORGANISMS,
R133 CRUDE OIL, BIODEGRADATION, BACTERIA, SEA SURFACE, SEDIMENTS, OCEANS, ESTUARIES, *WATER COLUMN,
R134 CRUDE OIL, BIODEGRADATION, MICROORGANISMS, INLAND, SOIL, SUBARCTIC REGIONS,
0621 CRUDE OIL WASHING, TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, IMCO, *LOAD-ON-TOP,
1145 CRUDE OIL WASHING, IMCO, TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION,
1146 CRUDE OIL WASHING, AMOCO CADIZ SPILL, TANKERS, IMCO, INTERNATIONAL AGREEMENTS, SEGREGATED BALLAST, SAFETY,
1149 CRUDE OIL WASHING, IMCO, TANKERS, INTERNATIONAL CONVENTIONS, SEGREGATED BALLAST, POLLUTION PREVENTION,
0946 CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, WSF, FUEL OIL, *CANCER IRRORATUS,
0949 CRUSTACEANS, CONTAMINANTS, MORTALITY, MARINE ORGANISMS, *LETHAL CONCENTRATION, *DAPHNIA MAGNA,
0959 CRUSTACEANS, CRUDE OIL, WSF, FUEL OIL, TOXICITY, MORTALITY, *LARVAE,
0972 CRUSTACEANS, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, FUEL OIL, MARSHES, RECOVERY, *UCA PUGNAX,
0979 CRUSTACEANS, AMPHIPODS, TOXICITY, FUEL OIL, *EXPERIMENTAL VARIABLES, *NEOHAUSTORIUS SCHMITZI,
0983 CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, WSF, GROWTH, *MOLTING, *MESIDOTEA ENTOMON,
0991 CRUSTACEANS, CRUDE OIL, ARCTIC, ACUTE EFFECTS, DISPERSANTS, TOXICITY, MORTALITY, *COREXIT 9527,
1082 CRUSTACEANS, BIODEGRADATION, HYDROCARBONS , METABOLISM, *CALLINECTES SAPIDUS, POLYCHAETES, *NEREIS SP., *ARYL HYDROCARBON HYDROXYLASE,
R095 CRUSTACEANS, BEHAVIOR, GROWTH, DEVELOPMENT , *LARVAE, *HOMARUS AMERICANUS,
R106 CRUSTACEANS, BIOLOGICAL EFFECTS, BIOINDICATORS, WASTEWATERS, REFINERIES, MOLLUSKS, PACIFIC OCEAN,
0812 DECOMPOSITION, CRUDE OIL, SPILL REMOVAL, EMULSIFICATION, YEAST, PATENT, *RICE BRAN,
R098 DECOMPOSITION, CRUDE OIL, ARCTIC, FATE, ENVIRONMENTAL EFFECTS, PLANTS, *TUNDRA,
1050 DEEPWATER PORTS, DEVELOPMENT , ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, US,
1059 DEEPWATER PORTS, BAHAMAS, TANKERS, OIL SPILLS, ENVIRONMENTAL PROTECTION,
1060 DEEPWATER PORTS, BASELINE STUDIES, AROMATIC HYDROCARBONS, SEAWATER, SAMPLING, SPECTROSCOPY, GULF OF MEXICO,
1067 DEEPWATER PORTS, GULF OF MEXICO, ENVIRONMENTAL EFFECTS,
1133 DEEPWATER PORTS, OCS, ENVIRONMENTAL PROTECTION, LEGISLATION, LIABILITY, SANTA BARBARA CHANNEL,

1154 DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, PORTS , ENVIRONMENTAL EFFECTS, OIL SPILLS, *SUPERTANKERS,
1155 DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, PORTS , ENVIRONMENTAL EFFECTS, *SUPERTANKERS,
R067 DELAWARE, CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, HYDROCARBONS , OXIDATION, SEDIMENTS, UPTAKE, *CHARACTERIZATION,
0738 DELAWARE BAY, REMOTE SENSING, MODELS, DRIFT, SPREADING, *DENSITY FRONTS, *SATELLITES, *LANDSAT,
0928 DELAWARE BAY, CONTINGENCY PLANNING, OIL TRANSFER, OIL SPILLS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS,
0808 DESIGN-ENGINEERING, SPILL REMOVAL, PATENT, SORBENTS,
0811 DESIGN-ENGINEERING, SKIMMERS, SPILL REMOVAL, PRODUCT INFORMATION, USCG, *ZRV SKIMMER,
0817 DESIGN-ENGINEERING, BOOMS, ICE, SPILL CLEANUP, SPILL CONTAINMENT,
0823 DESIGN-ENGINEERING, TANKERS, SAFETY, POLLUTION PREVENTION, EQUIPMENT, *DESTATOR DEVICE,
0834 DESIGN-ENGINEERING, WASTEWATER TREATMENT, FLOTATION, LUBRICATING OIL, EQUIPMENT,
0844 DESIGN-ENGINEERING, WASTEWATER TREATMENT, POLLUTION CONTROL, REFINERIES, *TAIWAN,
0863 DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, TANKERS, OIL TERMINALS, USN, VIRGINIA,
0869 DESIGN-ENGINEERING, WASTEWATER TREATMENT, PATENT, *FIBER AGGREGATES,
0880 DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT, EQUIPMENT,
0894 DESIGN-ENGINEERING, OIL-WATER SEPARATION, EQUIPMENT, EMULSIONS, PATENT, *ELECTRIC TREATMENT,
0902 DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, PATENT, FILTRATION ,
0904 DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT, SLUDGE ,
0908 DESIGN-ENGINEERING, OIL-WATER SEPARATION, GRAVITY SEPARATION, PATENT, EQUIPMENT,
0921 DESIGN-ENGINEERING, PERSONNEL TRAINING, PLATFORMS, TANKERS, SHIPS, OIL TRANSPORT, SAFETY, MANUALS,
1148 DESIGN-ENGINEERING, GUIDELINES, IMCO, ECONOMICS, TANKERS, POLLUTION PREVENTION,
R077 DESIGN-ENGINEERING, EQUIPMENT, SURVEILLANCE, LEAKAGE, POLLUTION CONTROL, SAFETY, *REMOTE CONTROL HOVERCRAFT,
R079 DESIGN-ENGINEERING, PIPELINES, OFFSHORE DEVELOPMENT, POLLUTION PREVENTION,
R084 DESIGN-ENGINEERING, OIL TANKS, STORAGE, OIL-WATER SEPARATION, RECLAMATION, USN, *TANK CLEANING,
0731 DETECTION, MONITORING, EQUIPMENT, PATENT, *FLUORESCENCE ANALYSIS,
0732 DETECTION, MONITORING, SEDIMENTS, SOIL, FUEL OIL, *ELECTRICAL RESISTIVITY,
0737 DETECTION, COASTS, REMOTE SENSING, MONITORING, ESTUARIES,
0739 DETECTION, REMOTE SENSING, *LASER-INDUCED FLUORESCENCE,
0759 DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, WASTEWATERS, *SPECTROFLUOROMETRY,
0760 DETECTION, CHEMICAL ANALYSIS, WASTEWATERS, SURFACTANTS, EXTRACTION, *MEASUREMENT ERROR,
0763 DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SEAWATER,
0778 DETECTION, SOURCE IDENTIFICATION, OIL SPILLS, PLATFORMS, OIL TRANSFER, NORWAY, *LASER SYSTEM,
1026 DETECTION, BIOLOGICAL EFFECTS, MARINE ORGANISMS, *REVIEW,
R069 DETECTION, ANALYTICAL TECHNIQUES, HYDROCARBONS , USN, *OIL/GREASE IN WATER,
0740 DEVELOPMENT , BOOK REVIEW, REMOTE SENSING, FOSSIL FUELS, MONITORING, ENVIRONMENTAL EFFECTS,
1050 DEVELOPMENT , DEEPWATER PORTS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, US,
1057 DEVELOPMENT , BASELINE STUDIES, EIS, OIL SHALE, POLLUTION CONTROL, RESOURCE MANAGEMENT,
1066 DEVELOPMENT , BLM, OCS, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, *ENVIRONMENTAL STUDIES PROGRAM,
1153 DEVELOPMENT , COASTS, BIBLIOGRAPHIES, ESTUARIES, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS,
R095 DEVELOPMENT , CRUSTACEANS, BEHAVIOR, GROWTH, *LARVAE, *HOMARUS AMERICANUS,
R100 DEVELOPMENT , CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, HYDROCARBONS , INVERTEBRATES, FISH, GROWTH,
R114 DEVELOPMENT , BIRDS, HABITATS, ENVIRONMENTAL EFFECTS, OIL TRANSPORT, PIPELINES, ALASKA, *WETLAND RESOURCES,
R115 DEVELOPMENT , ARCTIC, ANIMALS, MARINE MAMMALS, FOOD WEB, HABITATS, PIPELINES,
R120 DEVELOPMENT , COASTS, OIL INDUSTRY, LOUISIANA,
R123 DEVELOPMENT , BASELINE STUDIES, ENVIRONMENTAL MANAGEMENT, HYDROCARBONS , MARINE ORGANISMS, MODELS, PUGET SOUND,
R125 DEVELOPMENT , OCS, MARINE ORGANISMS, INTERTIDAL ZONE, BIOINDICATORS, ENVIRONMENTAL EFFECTS, ENVIRONMENTAL PROTECTION, GUIDELINES, ALASKA,
0784 DISPERSANTS, BIODEGRADATION, SPILL CLEANUP, *COMBUSTION, *COASTAL WATERS,
0786 DISPERSANTS, SPILL CLEANUP, PATENT,
0791 DISPERSANTS, TOXICITY, ENVIRONMENTAL EFFECTS, SPILL REMOVAL, TORREY CANYON SPILL, UK,
0803 DISPERSANTS, BALTIC SEA, SURFACTANTS, EMULSIONS, SPILL CLEANUP, TANKERS,
0816 DISPERSANTS, SPILL CLEANUP, PETROLEUM PRODUCTS, PATENT,
0882 DISPERSANTS, OIL-WATER SEPARATION, FILTRATION , PATENT,
0933 DISPERSANTS, CANADA, POLLUTION CONTROL, EQUIPMENT, SPILL CLEANUP, *DISPERSANT TECHNOLOGY,
0961 DISPERSANTS, BIOLOGICAL EFFECTS, ALGAE, TOXICITY, *CELL MEMBRANES, *NITELLA FLEXILIS,
0967 DISPERSANTS, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, PHYTOPLANKTON, *COREXIT, *PRIMARY PRODUCTION,
0970 DISPERSANTS, ARCTIC, PHYTOPLANKTON, PETROLEUM PRODUCTS, MORTALITY, *COREXIT 7664, *DIPROKSAMIN 157,

0980 DISPERSANTS, BACTERIA, MICROORGANISMS, PETROLEUM PRODUCTS, *DIPROKSAMIN 157, *COREXIT 7664,

0991 DISPERSANTS, CRUSTACEANS, CRUDE OIL, ARCTIC, ACUTE EFFECTS, TOXICITY, MORTALITY, *COREXIT 9527,

0999 DISPERSANTS, CRUDE OIL, TOXICITY, SEAWATER, PHYTOPLANKTON, *CARBON FIXATION, *COREXIT 9527,

1016 DISPERSANTS, BEACH CLEANUP, RECOVERY, *RECOLONIZATION, SHORELINES, MARINE ORGANISMS, TORREY CANYON SPILL, UK,

1080 DISPERSANTS, CRUDE OIL, BIODEGRADATION, HYDROCARBONS , MICROORGANISMS, TAR,

1151 DISPERSANTS, CANADA, BIBLIOGRAPHIES, FATE, ENVIRONMENTAL EFFECTS,

R071 DISPERSANTS, DISPERSIONS, SPILL CLEANUP, FATE,

R072 DISPERSANTS, FATE, DISPERSIONS, SPILL CLEANUP,

R074 DISPERSANTS, EQUIPMENT, SAMPLING, SPILL CLEANUP, *APPLICATION,

R076 DISPERSANTS, BIRDS, SPILL REMOVAL, MANUALS, POLLUTION PREVENTION, SAFETY, ENVIRONMENTAL PROTECTION,

R088 DISPERSANTS, BIOLOGICAL EFFECTS, BIOASSAY, MARINE ORGANISMS, TOXICITY,

R141 DISPERSANTS, BIODEGRADATION, FATE, MODELS, OIL SPILLS, WEATHERING, EVAPORATION, *PREDICTION,

1046 DISPERSIONS, BIODEGRADATION, BEAUFORT SEA, OIL SPILLS, FATE, MEDITERRANEAN SEA,

1098 DISPERSIONS, WEATHERING, INTERTIDAL ZONE, *MECHANICAL ENERGY,

1100 DISPERSIONS, BEHAVIOR, FATE, MODELS, MOVEMENT,

1119 DISPERSIONS, SEA SURFACE, *AIR-WATER INTERFACE, *BURSTING BUBBLES,

1124 DISPERSIONS, MODELS, ESTUARIES, *CONSERVATIVE AND NON-CONSERVATIVE POLLUTANTS,

R059 DISPERSIONS, MONITORING, OIL SPILLS, OCEANS, *CURRENT SENSOR, *INCLINING SPAR BUOY,

R071 DISPERSIONS, DISPERSANTS, SPILL CLEANUP, FATE,

R072 DISPERSIONS, DISPERSANTS, FATE, SPILL CLEANUP,

R110 DISPERSIONS, COASTS, BEHAVIOR, BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL, SEDIMENTATION,

R135 DISPERSIONS, BEHAVIOR, OIL SLICKS, FATE, MODELS,

R137 DISPERSIONS, CHEMICAL EFFECTS, OIL SLICKS, MODELS, PHYSICAL EFFECTS, EMULSIONS, *WAVE ACTION,

0813 DISPOSAL , MANUALS, MONITORING, GROUNDWATER, ENVIRONMENTAL EFFECTS, *OIL SPILL DEBRIS, *LANDFILLS,

0837 DISPOSAL , WASTE OIL, RECYCLING, INDUSTRIES,

0851 DISPOSAL , WASTE OIL, INCINERATION, FUEL OIL, *STACK EMISSIONS,

0853 DISPOSAL , INDUSTRIES, GOVERNMENT AGENCIES, WASTE OIL, TOXICITY,

0872 DISPOSAL , CARCINOGENS, AROMATIC HYDROCARBONS, WASTE OIL, LUBRICATING OIL, REFINING, RECLAMATION,

0873 DISPOSAL , BEAUFORT SEA, WASTEWATERS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, *DRILLING MUD,

0914 DISPOSAL , WASTE OIL, REFINING, RECYCLING, ENVIRONMENTAL MANAGEMENT, ECONOMICS, OIL INDUSTRY,

0931 DISPOSAL , ATLANTIC COAST, OFFSHORE DRILLING, OCS, RESOURCE MANAGEMENT, MODELS, POLLUTION PREVENTION, *WORKSHOP,

0937 DISPOSAL , LUBRICATING OIL, POLLUTION PREVENTION, OIL SLICKS, POLLUTION CONTROL, REUSE,

1038 DISPOSAL , CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, HEALTH HAZARDS, *TRACE METALS, *ASPHALT,

1068 DISPOSAL , BIODEGRADATION, BACTERIA, WASTE OIL, SOIL, *BIODISPOSAL FARMING,

1077 DISPOSAL , BIODEGRADATION, SLUDGE , REFINERIES, SOIL, INCINERATION, *LAND FARMING,

R080 DISPOSAL , SOLID WASTES, REFINERIES, REGULATIONS, WASTEWATER TREATMENT, *DATA BASE,

0749 DISTILLATION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, PAH, SPECTROMETRY,

0815 DISTILLATION, ABSORPTION, SPILL REMOVAL, PATENT, *CEMENT,

0776 DISTRIBUTION, SAMPLING, HYDROCARBONS , SEAWATER, SEDIMENTS, MARINE ORGANISMS,

0971 DISTRIBUTION, CARCINOGENS, FATE, PAH, HYDROCARBONS , METABOLISM, MARINE ORGANISMS, *PROCEEDINGS, *NEOPLASIA,

1010 DISTRIBUTION, CHRONIC EFFECTS, BIOMASS, BENTHOS, RECOVERY, REFINERIES, WASTEWATER TREATMENT, *RECOLONIZATION,

1018 DISTRIBUTION, CHEDABUCTO BAY, BIODEGRADATION, BACTERIA, RECOVERY, MICROORGANISMS, SEDIMENTS,

1053 DISTRIBUTION, BIOGENIC HYDROCARBONS, BASELINE STUDIES, MARINE ORGANISMS, SEDIMENTS, MEXICO , *N-PARAFFINS,

1075 DISTRIBUTION, BIODEGRADATION, BACTERIA, HYDROCARBONS , JAPAN, *BISAN SETO,

1102 DISTRIBUTION, CHEMICAL ANALYSIS, BIODEGRADATION, FATE, HYDROCARBONS , SEDIMENTS, SEAWATER, *PROCEEDINGS,

1103 DISTRIBUTION, BEACHES, BAHAMAS, TAR, SAMPLING,

1106 DISTRIBUTION, BIODEGRADATION, AROMATIC HYDROCARBONS, SOURCES, FATE,

1110 DISTRIBUTION, CONTAMINANTS, CARCINOGENS, PAH, SOURCES, HEALTH HAZARDS, METABOLISM,

R140 DISTRIBUTION, BIOGENIC HYDROCARBONS, FATE, PETROCHEMICALS, SEDIMENTATION, OCEANS,

0738 DRIFT, DELAWARE BAY, REMOTE SENSING, MODELS, SPREADING, *DENSITY FRONTS, *SATELLITES, *LANDSAT,

1123 DRIFT, MODELS, OIL SLICKS, LABRADOR SEA, OFFSHORE DRILLING,

1035 DRILLING , OIL SPILLS, OCEANS, TANKERS,

R117 DRILLING , ESTUARIES, PHYTOPLANKTON, ENVIRONMENTAL EFFECTS, LOUISIANA, *CARBON FLUX,

R121 DRILLING , CONTAMINATION, ANALYTICAL TECHNIQUES, RESOURCE MANAGEMENT, GROUNDWATER, ECONOMIC EFFECTS, *ENHANCED OIL RECOVERY , *WATER RESOURCES,

0954 ECHINODERMS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, UPTAKE, INTERTIDAL ZONE, WEATHERING, *GENERAL M.C. MEIGS SPILL,
1042 ECONOMIC EFFECTS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, SOCIAL EFFECTS, NORTH CAROLINA, *COASTAL PLAINS,
1050 ECONOMIC EFFECTS, DEVELOPMENT , DEEPWATER PORTS, ENVIRONMENTAL EFFECTS, US,
R121 ECONOMIC EFFECTS, DRILLING , CONTAMINATION, ANALYTICAL TECHNIQUES, RESOURCE MANAGEMENT, GROUNDWATER, *ENHANCED OIL RECOVERY , *WATER RESOURCES,
0830 ECONOMICS, WASTE OIL TREATMENT, EMULSIONS, REFINING, INDUSTRIES, EQUIPMENT, *TECHNOLOGY REVIEW,
0914 ECONOMICS, DISPOSAL , WASTE OIL, REFINING, RECYCLING, ENVIRONMENTAL MANAGEMENT, OIL INDUSTRY,
1147 ECONOMICS, GUIDELINES, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, SHIPS,
1148 ECONOMICS, DESIGN-ENGINEERING, GUIDELINES, IMCO, TANKERS, POLLUTION PREVENTION,
1006 ECOSYSTEMS, RECOVERY, ENVIRONMENTAL DETERIORATION, RESOURCE MANAGEMENT,
1012 ECOSYSTEMS, CHRONIC EFFECTS, INTERTIDAL ZONE, RECOVERY, *SYMPOSIUM SUMMARY,
1017 ECOSYSTEMS, BIOLOGICAL EFFECTS, RECOVERY, FATE, INTERTIDAL ZONE, *PROCEEDINGS,
1019 ECOSYSTEMS, RECOVERY, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS,
1040 ECOSYSTEMS, BIOLOGICAL EFFECTS, HYDROCARBONS , MARINE ORGANISMS, FATE, UPTAKE, METABOLISM, *PROCEEDINGS,
1093 ECOSYSTEMS, BIODEGRADATION, FRESHWATER, MICROORGANISMS, OIL SLICKS, *CONTINUOUS CULTURE,
R109 ECOSYSTEMS, ANALYTICAL TECHNIQUES, HYDROCARBONS , MARINE ORGANISMS, FATE, TOXICITY, ENVIRONMENTAL EFFECTS, SUBARCTIC REGIONS, NOAA,
R119 ECOSYSTEMS, CONTAMINANTS, OIL FIELDS, ENVIRONMENTAL EFFECTS, GULF OF MEXICO,
1057 EIS, DEVELOPMENT , BASELINE STUDIES, OIL SHALE, POLLUTION CONTROL, RESOURCE MANAGEMENT,
1058 EIS, CRUDE OIL, STORAGE, FEA, LOUISIANA, *SALT DOME, *STRATEGIC PETROLEUM RESERVE,
0762 EKOFISK BLOWOUT, CHEMICAL ANALYSIS, FATE, SEDIMENTS, FISH,
1056 EKOFISK BLOWOUT, BIRDS, SCOTLAND, *SEABIRD POPULATION STUDY,
1122 EKOFISK BLOWOUT, BEHAVIOR, OIL SPILLS, SPREADING, MODELS, *OILSIM,
0812 EMULSIFICATION, DECOMPOSITION, CRUDE OIL, SPILL REMOVAL, YEAST, PATENT, *RICE BRAN,
R128 EMULSIFICATION, BIODEGRADATION, YEASTS, FUNGI, TOXICITY, GROWTH,
0793 EMULSIONS, ADSORPTION, SPILL CLEANUP, PATENT, *EXPANDED PYROPHYLLITE,
0803 EMULSIONS, DISPERSANTS, BALTIC SEA, SURFACTANTS, SPILL CLEANUP, TANKERS,
0828 EMULSIONS, WASTEWATER TREATMENT, FLOTATION, *ELECTROFLOTATION,
0830 EMULSIONS, ECONOMICS, WASTE OIL TREATMENT, REFINING, INDUSTRIES, EQUIPMENT, *TECHNOLOGY REVIEW,
0832 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, LUBRICATING OIL, PH CONTROL,
0833 EMULSIONS, ABSORPTION, WASTEWATER TREATMENT, *COAGULATION, FLOCCULATION, PATENT,
0835 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, PATENT, *DETERGENT-OIL MIXTURES,
0836 EMULSIONS, ADSORPTION, WASTEWATER TREATMENT, PATENT,
0856 EMULSIONS, SLUDGE , WASTE OIL TREATMENT, SOIL, *COMPOSTING PROCESS,
0865 EMULSIONS, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, PATENT,
0875 EMULSIONS, WASTEWATER TREATMENT, FLOCCULATION, PATENT, FLOTATION,
0890 EMULSIONS, OIL-WATER SEPARATION, FILTRATION , PETROLEUM PRODUCTS,
0894 EMULSIONS, DESIGN-ENGINEERING, OIL-WATER SEPARATION, EQUIPMENT, PATENT, *ELECTRIC TREATMENT,
0898 EMULSIONS, OIL-WATER SEPARATION, EQUIPMENT, PATENT,
0901 EMULSIONS, OIL-WATER SEPARATION, PH CONTROL, FILTRATION ,
1095 EMULSIONS, ADSORPTION, FLOCCULATION, SEDIMENTATION, COAGULATION, *COLLOIDS,
R137 EMULSIONS, DISPERSIONS, CHEMICAL EFFECTS, OIL SLICKS, MODELS, PHYSICAL EFFECTS, *WAVE ACTION,
0714 ENVIRONMENTAL DETERIORATION, CONTAMINATION, ARGENTINA,
0727 ENVIRONMENTAL DETERIORATION, MONITORING, REFINERIES, OIL TERMINALS, UK,
1006 ENVIRONMENTAL DETERIORATION, ECOSYSTEMS, RECOVERY, RESOURCE MANAGEMENT,
1020 ENVIRONMENTAL DETERIORATION, CONSERVATION, OCEANS, RESOURCE MANAGEMENT, RECOVERY,
1031 ENVIRONMENTAL DETERIORATION, POLLUTION PREVENTION, MEDITERRANEAN SEA,
1163 ENVIRONMENTAL DETERIORATION, CONTAMINANTS, FUELS ,
0716 ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, FRANCE,
0722 ENVIRONMENTAL EFFECTS, COASTS, BEACH CLEANUP, AMOCO CADIZ SPILL, MARSHES, MARINE ORGANISMS, FISHERIES, FRANCE,
0726 ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY, MARINE ORGANISMS, INTERTIDAL ZONE, FRANCE,
0740 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BOOK REVIEW, REMOTE SENSING, FOSSIL FUELS, MONITORING,
0791 ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, SPILL REMOVAL, TORREY CANYON SPILL, UK,
0813 ENVIRONMENTAL EFFECTS, DISPOSAL , MANUALS, MONITORING, GROUNDWATER, *OIL SPILL DEBRIS, *LANDFILLS,
0873 ENVIRONMENTAL EFFECTS, DISPOSAL , BEAUFORT SEA, WASTEWATERS, OFFSHORE DRILLING, *DRILLING MUD,
0928 ENVIRONMENTAL EFFECTS, DELAWARE BAY, CONTINGENCY PLANNING, OIL TRANSFER, OIL SPILLS, POLLUTION CONTROL,
0947 ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIRDS, ESTUARIES,
0975 ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, PHYTOPLANKTON, INTERTIDAL ZONE,
1019 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, RECOVERY, INTERTIDAL ZONE,

1021 ENVIRONMENTAL EFFECTS, COASTS, COASTAL ZONE MANAGEMENT, BIOLOGICAL EFFECTS, HABITATS, SPILL CLEANUP,
1029 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, SOURCES, FATE,
1030 ENVIRONMENTAL EFFECTS, OIL SPILLS, INDUSTRIES, OCEANS,
1037 ENVIRONMENTAL EFFECTS, COASTS, OIL SPILLS, OCS, LEGISLATION,
1041 ENVIRONMENTAL EFFECTS, CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, HEALTH HAZARDS, *TRACE METALS,
1042 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY, SOCIAL EFFECTS, NORTH CAROLINA, *COASTAL PLAINS,
1044 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OFFSHORE DRILLING, OIL SPILLS,
1047 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, UK, PORTS , OIL TERMINALS, TANKERS, *OCEAN MANAGEMENT, *PROCEEDINGS,
1049 ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT, OFFSHORE PRODUCTION, OIL TRANSPORT,
1050 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DEVELOPMENT , DEEPWATER PORTS, US,
1051 ENVIRONMENTAL EFFECTS, GEORGES BANK, FISHERIES, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, RESOURCE MANAGEMENT,
1054 ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, *EDITORIAL,
1062 ENVIRONMENTAL EFFECTS, CRUDE OIL, BLM, BEAUFORT SEA, OCS, OFFSHORE DEVELOPMENT, GULF OF ALASKA,
1063 ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, MICROORGANISMS, ALASKA,
1064 ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, FISH, PLANKTON , INTERTIDAL ZONE, ALASKA,
1065 ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, SAFETY, STATISTICS, ALASKA, *HAZARDS,
1066 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BLM, OCS, OIL-GAS LEASING, *ENVIRONMENTAL STUDIES PROGRAM,
1067 ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, GULF OF MEXICO,
1151 ENVIRONMENTAL EFFECTS, DISPERSANTS, CANADA, BIBLIOGRAPHIES, FATE,
1153 ENVIRONMENTAL EFFECTS, DEVELOPMENT , COASTS, BIBLIOGRAPHIES, ESTUARIES, POLLUTION CONTROL,
1154 ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, PORTS , OIL SPILLS, *SUPERTANKERS,
1155 ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, PORTS , *SUPERTANKERS,
1156 ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, TOXICITY, *INFORMATION SOURCES ,
1167 ENVIRONMENTAL EFFECTS, CANADA, OIL TERMINALS, PIPELINES,
1171 ENVIRONMENTAL EFFECTS, INDUSTRIES, PRODUCTION , PETROLEUM PRODUCTS, *IMPACT MAPS,
R096 ENVIRONMENTAL EFFECTS, BIOGENIC HYDROCARBONS, ADSORPTION, HYDROCARBONS , SEDIMENTATION, ESTUARIES, MONITORING,
R098 ENVIRONMENTAL EFFECTS, DECOMPOSITION, CRUDE OIL, ARCTIC, FATE, PLANTS, *TUNDRA,
R109 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES, HYDROCARBONS , MARINE ORGANISMS, FATE, TOXICITY, SUBARCTIC REGIONS, NOAA,
R113 ENVIRONMENTAL EFFECTS, FUEL OIL, MARSHES, GROWTH, RECOVERY, MASSACHUSETTS,
R114 ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIRDS, HABITATS, OIL TRANSPORT, PIPELINES, ALASKA, *WETLAND RESOURCES,
R117 ENVIRONMENTAL EFFECTS, DRILLING , ESTUARIES, PHYTOPLANKTON, LOUISIANA, *CARBON FLUX,
R119 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, CONTAMINANTS, OIL FIELDS, GULF OF MEXICO,
R122 ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OIL SHALE, FISH, WILDLIFE, *POPULATION REDUCTIONS,
R125 ENVIRONMENTAL EFFECTS, DEVELOPMENT , OCS, MARINE ORGANISMS, INTERTIDAL ZONE, BIOINDICATORS, ENVIRONMENTAL PROTECTION, GUIDELINES, ALASKA,
R144 ENVIRONMENTAL EFFECTS, COASTS, OIL SPILLS, ALASKA, *VULNERABILITY, *KODIAK ISLAND,
0733 ENVIRONMENTAL MANAGEMENT, MONITORING, EPA, GOVERNMENT AGENCIES,
0914 ENVIRONMENTAL MANAGEMENT, ECONOMICS, DISPOSAL , WASTE OIL, REFINING, RECYCLING, OIL INDUSTRY,
R123 ENVIRONMENTAL MANAGEMENT, DEVELOPMENT , BASELINE STUDIES, HYDROCARBONS , MARINE ORGANISMS, MODELS, PUGET SOUND,
0922 ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, TANKERS, OIL SPILLS, SAFETY,
1043 ENVIRONMENTAL PROTECTION, OIL TRANSPORT, OIL TERMINALS, ALASKA,
1059 ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, BAHAMAS, TANKERS, OIL SPILLS,
1133 ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, OCS, LEGISLATION, LIABILITY, SANTA BARBARA CHANNEL,
1141 ENVIRONMENTAL PROTECTION, AMOCO CADIZ SPILL, SAFETY, TANKERS, OIL SPILLS, *NEGOTIATIONS,
1143 ENVIRONMENTAL PROTECTION, GOVERNMENT AGENCIES, OIL INDUSTRY, WILDLIFE, FISH, OIL SHALE, RESOURCE MANAGEMENT,
R076 ENVIRONMENTAL PROTECTION, DISPERSANTS, BIRDS, SPILL REMOVAL, MANUALS, POLLUTION PREVENTION, SAFETY,
R078 ENVIRONMENTAL PROTECTION, OIL TRANSPORT, PRODUCTION , PUGET SOUND,
R112 ENVIRONMENTAL PROTECTION, SHORELINES, MARSHES, RESTORATION, *SURFACE TREATMENT AGENTS,
R125 ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OCS, MARINE ORGANISMS, INTERTIDAL ZONE, BIOINDICATORS, GUIDELINES, ALASKA,
R148 ENVIRONMENTAL PROTECTION, COST ANALYSIS, API, REGULATIONS,
R150 ENVIRONMENTAL PROTECTION, COST ANALYSIS, API,
0733 EPA, ENVIRONMENTAL MANAGEMENT, MONITORING, GOVERNMENT AGENCIES,

0889 EPA, COALESCENCE, OIL-WATER SEPARATION, REUSE, REGULATIONS, PRODUCT INFORMATION,
1131 EPA, LEGISLATION, REFINERIES, WASTEWATER TREATMENT, *CLEAN WATER ACT 1977,
R062 EPA, API, SOLID WASTES, REFINERIES, TOXICITY, SLUDGE , *TANK CLEANING, WATER QUALITY,
R147 EPA, API, WATER QUALITY, OIL INDUSTRY, POLLUTION CONTROL, STATISTICAL ANALYSIS,
R149 EPA, COST ANALYSIS, API, MODELS, GUIDELINES, STATISTICAL ANALYSIS, REFINERIES, WASTEWATERS,
0730 EQUIPMENT, CHEMICAL ANALYSIS, MONITORING, *INFRARED DETECTION ,
0731 EQUIPMENT, DETECTION, MONITORING, PATENT, *FLUORESCENCE ANALYSIS,
0744 EQUIPMENT, SAMPLING, WASTEWATERS, WATER QUALITY, MONITORING,
0755 EQUIPMENT, SAMPLING, PETROLEUM PRODUCTS, PATENT,
0785 EQUIPMENT, BLACK SEA, SPILL REMOVAL, ICE, HARBORS,
0792 EQUIPMENT, CANADA, SPILL DISPOSAL, INCINERATION,
0800 EQUIPMENT, ARGO MERCHANT SPILL, SPILL CLEANUP, MONITORING, FATE, *ACCIDENT RESPONSE,
0801 EQUIPMENT, ARCTIC, SPILL CLEANUP, SPILL REMOVAL, *AMOP,
0805 EQUIPMENT, SKIMMERS, PRODUCT INFORMATION, *BRILL OIL SKIMMER,
0806 EQUIPMENT, BOOMS, SPILL CONTAINMENT, SPILL REMOVAL, SHIPS, PATENT,
0807 EQUIPMENT, CANADA, SPILL CLEANUP, ICE, RIVERS, SKIMMERS,
0823 EQUIPMENT, DESIGN-ENGINEERING, TANKERS, SAFETY, POLLUTION PREVENTION, *DESTATOR DEVICE,
0830 EQUIPMENT, EMULSIONS, ECONOMICS, WASTE OIL TREATMENT, REFINING, INDUSTRIES, *TECHNOLOGY REVIEW,
0834 EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, FLOTATION, LUBRICATING OIL,
0880 EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
0886 EQUIPMENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, SPILL REMOVAL, PRODUCT INFORMATION, *ENQUIP INC,
0887 EQUIPMENT, OIL-WATER SEPARATION, *CYCLONET,
0888 EQUIPMENT, COALESCENCE, OIL-WATER SEPARATION, GRAVITY SEPARATION, PRODUCT INFORMATION,
0891 EQUIPMENT, OIL-WATER SEPARATION, SOLID WASTES, PATENT, *SLURRIES,
0894 EQUIPMENT, EMULSIONS, DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT, *ELECTRIC TREATMENT,
0897 EQUIPMENT, BILGES, ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, SEAWATER, FILTRATION PATENT,
0898 EQUIPMENT, EMULSIONS, OIL-WATER SEPARATION, PATENT,
0903 EQUIPMENT, OIL-WATER SEPARATION, HYDROCARBONS , PATENT,
0908 EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, GRAVITY SEPARATION, PATENT,
0909 EQUIPMENT, ADSORPTION, OIL-WATER SEPARATION, GRAVITY SEPARATION, WASTEWATERS, PATENT,
0929 EQUIPMENT, POLLUTION PREVENTION, OFFSHORE DRILLING, PLATFORMS, PATENT,
0933 EQUIPMENT, DISPERSANTS, CANADA, POLLUTION CONTROL, SPILL CLEANUP, *DISPERSANT TECHNOLOGY,
0935 EQUIPMENT, PRODUCT INFORMATION, MONITORING, LEAKAGE, PIPELINES, OIL TANKS, *ACOUSTIC EMISSION MONITOR,
1157 EQUIPMENT, SAFETY, POLLUTION PREVENTION, OFFSHORE PRODUCTION, *ACCREDITATION, *TESTING LABORATORIES,
1158 EQUIPMENT, SAFETY, POLLUTION PREVENTION, OFFSHORE PRODUCTION, *QUALITY ASSURANCE, *CERTIFICATION,
1168 EQUIPMENT, POLLUTION CONTROL, EUROPE, INDUSTRY, *DIRECTORY,
R074 EQUIPMENT, DISPERSANTS, SAMPLING, SPILL CLEANUP, *APPLICATION,
R077 EQUIPMENT, DESIGN-ENGINEERING, SURVEILLANCE, LEAKAGE, POLLUTION CONTROL, SAFETY, *REMOTE CONTROL HOVERCRAFT,
0737 ESTUARIES, DETECTION, COASTS, REMOTE SENSING, MONITORING,
0877 ESTUARIES, COASTS, WASTEWATERS, HYDROCARBONS , FATE, SEDIMENTATION, RIVERS, NARRAGANSETT BAY, *PROVIDENCE RIVER,
0947 ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIRDS,
0960 ESTUARIES, BIOLOGICAL EFFECTS, BIODEGRADATION, BACTERIA, MARSHES, MICROORGANISMS,
1039 ESTUARIES, BIODEGRADATION, MARSHES, SUBLETHAL EFFECTS, MARINE ORGANISMS, MICROORGANISMS, *PROCEEDINGS,
1107 ESTUARIES, CONTAMINANTS, FATE, MODELS, FOSSIL FUELS, SEDIMENTS,
1117 ESTUARIES, CRUDE OIL, PAH, SEDIMENTS, SOURCES, UK,
1124 ESTUARIES, DISPERSIONS, MODELS, *CONSERVATIVE AND NON-CONSERVATIVE POLLUTANTS,
1152 ESTUARIES, BIBLIOGRAPHIES, OCEANS,
1153 ESTUARIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT , COASTS, BIBLIOGRAPHIES, POLLUTION CONTROL,
R096 ESTUARIES, ENVIRONMENTAL EFFECTS, BIOGENIC HYDROCARBONS, ADSORPTION, HYDROCARBONS , SEDIMENTATION, MONITORING,
R111 ESTUARIES, CRUDE OIL, CHEMICAL EFFECTS, ACUTE EFFECTS, MARSHES, FOOD WEB, RECOVERY,
R117 ESTUARIES, ENVIRONMENTAL EFFECTS, DRILLING , PHYTOPLANKTON, LOUISIANA, *CARBON FLUX,
R127 ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, FUNGI, MARSHES, SEDIMENTS,
R130 ESTUARIES, CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, FOOD WEB, UPTAKE, NEW JERSEY,
R133 ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, SEA SURFACE, SEDIMENTS, OCEANS, *WATER COLUMN,
0717 EUROPE, PIPELINES, PETROLEUM PRODUCTS, OIL INDUSTRY, STATISTICS, OIL SPILLS,
0736 EUROPE, REMOTE SENSING, MONITORING, SURVEILLANCE, LEGISLATION, *SATELLITES,
0825 EUROPE, WASTEWATER TREATMENT, REFINERIES, WATER QUALITY, STATISTICS,
1140 EUROPE, OIL INDUSTRY, REGULATIONS, POLLUTION PREVENTION,
1168 EUROPE, EQUIPMENT, POLLUTION CONTROL, INDUSTRY, *DIRECTORY,

1097 EVAPORATION, CRUDE OIL, PETROLEUM PRODUCTS, FUELS , MODELS, *EQUATIONS,
1099 EVAPORATION, CRUDE OIL, OIL SLICKS, SPREADING, MOVEMENT, LAKES ,
1115 EVAPORATION, BIODEGRADATION, OIL SPILLS, SEAWATER, *KINETICS,
R073 EVAPORATION, BOOMS, SPILL CLEANUP, SKIMMERS, SORBENTS, *FOAMS, *GELS,
R141 EVAPORATION, DISPERSANTS, BIODEGRADATION, FATE, MODELS, OIL SPILLS, WEATHERING, *PREDICTION,
0760 EXTRACTION, DETECTION, CHEMICAL ANALYSIS, WASTEWATERS, SURFACTANTS, *MEASUREMENT ERROR,
0768 EXTRACTION, CONTAMINANTS, CHEMICAL ANALYSIS, ADSORPTION, *MACRORETICULAR RESINS,
0775 EXTRACTION, CHEMICAL ANALYSIS, SPECTROMETRY, WASTEWATERS,
0919 EXTRACTION, CRANKCASE OIL, WASTE OIL TREATMENT, PATENT, RECLAMATION,
0762 FATE, EKOFISK BLOWOUT, CHEMICAL ANALYSIS, SEDIMENTS, FISH,
0800 FATE, EQUIPMENT, ARGO MERCHANT SPILL, SPILL CLEANUP, MONITORING, *ACCIDENT RESPONSE,
0877 FATE, ESTUARIES, COASTS, WASTEWATERS, HYDROCARBONS , SEDIMENTATION, RIVERS, NARRAGANSETT BAY, *PROVIDENCE RIVER,
0971 FATE, DISTRIBUTION, CARCINOGENS, PAH, HYDROCARBONS , METABOLISM, MARINE ORGANISMS, *PROCEEDINGS, *NEOPLASIA,
1017 FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, RECOVERY, INTERTIDAL ZONE, *PROCEEDINGS,
1029 FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, SOURCES,
1040 FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, HYDROCARBONS , MARINE ORGANISMS, UPTAKE, METABOLISM, *PROCEEDINGS,
1046 FATE, DISPERSIONS, BIODEGRADATION, BEAUFORT SEA, OIL SPILLS, MEDITERRANEAN SEA,
1100 FATE, DISPERSIONS, BEHAVIOR, MODELS, MOVEMENT,
1101 FATE, BIODEGRADATION, WEATHERING, RECOVERY, *SYMPOSIUM SUMMARY,
1102 FATE, DISTRIBUTION, CHEMICAL ANALYSIS, BIODEGRADATION, HYDROCARBONS , SEDIMENTS, SEAWATER, *PROCEEDINGS,
1105 FATE, CHROMATOGRAPHY, CANADA, BIODEGRADATION, BAYS, FUEL OIL, HYDROCARBONS , SOURCE IDENTIFICATION, *PENTACYCLIC TRITERPANES,
1106 FATE, DISTRIBUTION, BIODEGRADATION, AROMATIC HYDROCARBONS, SOURCES,
1107 FATE, ESTUARIES, CONTAMINANTS, MODELS, FOSSIL FUELS, SEDIMENTS,
1109 FATE, CHEDABUCTO BAY, SEDIMENTS, FUEL OIL, INTERTIDAL ZONE, *ARROW SPILL,
1111 FATE, CONTAMINATION, BIOLOGICAL EFFECTS, MARINE ORGANISMS, OFFSHORE DRILLING, SHORELINES,
1112 FATE, CHEMICAL ANALYSIS, WEATHERING, SEDIMENTS, SAMPLING, MAINE, *MYA ARENARIA,
1114 FATE, BEHAVIOR, ARGO MERCHANT SPILL, NORTH SEA, SPILL CLEANUP,
1116 FATE, MODELS, SEA SURFACE, HYDROCARBONS ,
1120 FATE, TAR, SEAWATER, MODELS, *PETROLEUM PARTICLES,
1151 FATE, ENVIRONMENTAL EFFECTS, DISPERSANTS, CANADA, BIBLIOGRAPHIES,
R071 FATE, DISPERSIONS, DISPERSANTS, SPILL CLEANUP,
R072 FATE, DISPERSIONS, DISPERSANTS, SPILL CLEANUP,
R087 FATE, BEHAVIOR, SOURCE IDENTIFICATION, OIL SPILLS, SPILL CLEANUP, SURVEILLANCE, POLLUTION PREVENTION,
R098 FATE, ENVIRONMENTAL EFFECTS, DECOMPOSITION, CRUDE OIL, ARCTIC, PLANTS, *TUNDRA,
R109 FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES, HYDROCARBONS , MARINE ORGANISMS, TOXICITY, SUBARCTIC REGIONS, NOAA,
R126 FATE, BIODEGRADATION, MONITORING, TOXICITY, SOIL,
R131 FATE, CRUDE OIL, BIODEGRADATION, MICROORGANISMS,
R135 FATE, DISPERSIONS, BEHAVIOR, OIL SLICKS, MODELS,
R138 FATE, OIL SLICKS, SPREADING, MODELS, SPILL CLEANUP,
R140 FATE, DISTRIBUTION, BIOGENIC HYDROCARBONS, PETROCHEMICALS, SEDIMENTATION, OCEANS,
R141 FATE, EVAPORATION, DISPERSANTS, BIODEGRADATION, MODELS, OIL SPILLS, WEATHERING, *PREDICTION,
R142 FATE, CHEMICAL ANALYSIS, BENTHOS, HYDROCARBONS , SEAWATER, SEDIMENTS, SARGASSO SEA, *TRANSPORT ,
R143 FATE, COASTS, MODELS, OIL SPILLS, NOAA, *SPILL TRAJECTORY,
R145 FATE, BIODEGRADATION, MODELS, MARINE ORGANISMS, HYDROCARBONS , OIL SLICKS,
R146 FATE, BEHAVIOR, MODELS, OIL SPILLS, *PREDICTIONS,
1058 FEA, EIS, CRUDE OIL, STORAGE, LOUISIANA, *SALT DOME, *STRATEGIC PETROLEUM RESERVE,
0838 FILTRATION , WASTEWATER TREATMENT, REFINERIES, FLOTATION, *PILOT STUDY, *MICROSCREENING,
0840 FILTRATION , COALESCENCE, BALLAST , OIL-WATER SEPARATION, GRAVITY SEPARATION, PATENT, *DEWAXING UNIT,
0859 FILTRATION , OIL-WATER SEPARATION, SLUDGE , GRAVITY SEPARATION, PATENT, WASTEWATER TREATMENT,
0864 FILTRATION , WASTEWATER TREATMENT, RECYCLING, PATENT,
0867 FILTRATION , WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOTATION, INCINERATION, SHIPS,
0881 FILTRATION , CONTAMINANTS, OIL-WATER SEPARATION, FRESHWATER, PATENT,
0882 FILTRATION , DISPERSANTS, OIL-WATER SEPARATION, PATENT,
0890 FILTRATION , EMULSIONS, OIL-WATER SEPARATION, PETROLEUM PRODUCTS,
0893 FILTRATION , OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOTATION, FLOCCULATION, PATENT,
0897 FILTRATION , EQUIPMENT, BILGES, ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, SEAWATER, PATENT,
0901 FILTRATION , EMULSIONS, OIL-WATER SEPARATION, PH CONTROL,
0902 FILTRATION , DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, PATENT,

0710 FISH, COMPENSATION, OIL SPILLS, MORTALITY, *ADRIAN MAERSK SPILL, *HONG KONG,
0762 FISH, FATE, EKOFISK BLOWOUT, CHEMICAL ANALYSIS, SEDIMENTS,
0973 FISH, CONTAMINATION, BIOLOGICAL EFFECTS, *DIESEL 2 OIL, *BLENNIUS PAVO,
0977 FISH, CRUDE OIL, BIOLOGICAL EFFECTS, *EKOFISK OIL, *LARVAE,
0978 FISH, CRUDE OIL, BIOLOGICAL EFFECTS, UPTAKE, SEDIMENTS, TOXICITY, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0981 FISH, CRUDE OIL, CHRONIC EFFECTS, SUBLETHAL EFFECTS, *TISSUES, *TAUTOGOLABRUS ADSPERSUS,
0985 FISH, CRUDE OIL, BIOASSAY, ACUTE EFFECTS, MORTALITY, GROWTH, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
0989 FISH, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, METABOLISM, PAH, *ONCORHYNCHUS KISUTCH,
0996 FISH, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, RECOVERY, FLORIDA SPILL, *FUNDULUS HETEROCLITUS,
1064 FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, PLANKTON , INTERTIDAL ZONE, ALASKA,
1143 FISH, ENVIRONMENTAL PROTECTION, GOVERNMENT AGENCIES, OIL INDUSTRY, WILDLIFE, OIL SHALE, RESOURCE MANAGEMENT,
1169 FISH, CONTAMINANTS, BEHAVIOR, ANALYTICAL TECHNIQUES, TOXICITY,
R065 FISH, BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, REFINERIES, WASTEWATERS, FRESHWATER, INTERTIDAL ZONE, INVERTEBRATES,
R082 FISH, BIOASSAY, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, GROWTH, PHYTOPLANKTON, WATER QUALITY,
R090 FISH, CONTAMINATION, CHRONIC EFFECTS, MARSHES, INVERTEBRATES, BIOINDICATORS,
R092 FISH, HYDROCARBONS , SUBLETHAL EFFECTS, METABOLISM, *TEMPERATURE,
R093 FISH, HYDROCARBONS , SUBLETHAL EFFECTS, METABOLISM, *TEMPERATURE,
R100 FISH, DEVELOPMENT , CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, HYDROCARBONS , INVERTEBRATES, GROWTH,
R105 FISH, CHRONIC EFFECTS, HYDROCARBONS , METABOLISM,
R122 FISH, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, OIL SHALE, WILDLIFE, *POPULATION REDUCTIONS,
0722 FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BEACH CLEANUP, AMOCO CADIZ SPILL, MARSHES, MARINE ORGANISMS, FRANCE,
1051 FISHERIES, ENVIRONMENTAL EFFECTS, GEORGES BANK, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, RESOURCE MANAGEMENT,
R124 FISHERIES, BASELINE STUDIES, GULF OF MEXICO, *MACKEREL,
0833 FLOCCULATION, EMULSIONS, ABSORPTION, WASTEWATER TREATMENT, *COAGULATION, PATENT,
0875 FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT, PATENT, FLOTATION,
0878 FLOCCULATION, CONTAMINANTS, WASTEWATER TREATMENT, HYDROCARBONS , PAH,
0893 FLOCCULATION, FILTRATION , OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOTATION, PATENT,
1095 FLOCCULATION, EMULSIONS, ADSORPTION, SEDIMENTATION, COAGULATION, *COLLOIDS,
0990 FLORIDA SPILL, BUZZARDS BAY, BENTHOS, MARINE ORGANISMS, INTERTIDAL ZONE, SEDIMENTS, STATISTICAL ANALYSIS,
0996 FLORIDA SPILL, FISH, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, RECOVERY, *FUNDULUS HETEROCLITUS,
0828 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, *ELECTROFLOTATION,
0834 FLOTATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, LUBRICATING OIL,
0838 FLOTATION, FILTRATION , WASTEWATER TREATMENT, REFINERIES, *PILOT STUDY, *MICROSCREENING,
0849 FLOTATION, WASTEWATER TREATMENT, SHIPS, PATENT, *ELECTROLYSIS,
0860 FLOTATION, WASTEWATER TREATMENT, *COAGULATION, USN, OIL TERMINALS, SKIMMERS,
0867 FLOTATION, FILTRATION , WASTEWATER TREATMENT, OIL-WATER SEPARATION, INCINERATION, SHIPS,
0875 FLOTATION, FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT, PATENT,
0893 FLOTATION, FLOCCULATION, FILTRATION , OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT,
1000 FOOD WEB, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, METABOLISM, FUEL OIL, *ENZYME ACTIVITY,
1076 FOOD WEB, BIODEGRADATION, ACTIVATED SLUDGE, TOXICITY, WASTEWATERS, MARINE ORGANISMS, YEASTS,
1104 FOOD WEB, BIODEGRADATION, HYDROCARBONS , PAH, SOURCES, UPTAKE, RELEASE, MARINE ORGANISMS,
R101 FOOD WEB, CORAL REEFS, HYDROCARBONS , *DRILLING MUD, UPTAKE, RELEASE, GROWTH, SEDIMENTATION,
R103 FOOD WEB, COASTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, BIOINDICATORS, *MYTILUS EDULIS,
R111 FOOD WEB, ESTUARIES, CRUDE OIL, CHEMICAL EFFECTS, ACUTE EFFECTS, MARSHES, RECOVERY,
R115 FOOD WEB, DEVELOPMENT , ARCTIC, ANIMALS, MARINE MAMMALS, HABITATS, PIPELINES,
R130 FOOD WEB, ESTUARIES, CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, UPTAKE, NEW JERSEY,
0740 FOSSIL FUELS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BOOK REVIEW, REMOTE SENSING, MONITORING,
1107 FOSSIL FUELS, FATE, ESTUARIES, CONTAMINANTS, MODELS, SEDIMENTS,
0711 FRANCE, COASTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, ACUTE EFFECTS, MARINE ORGANISMS,
0716 FRANCE, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL,
0722 FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BEACH CLEANUP, AMOCO CADIZ SPILL, MARSHES, MARINE ORGANISMS,

0726 FRANCE, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY, MARINE ORGANISMS, INTERTIDAL ZONE,
1032 FRANCE, COASTS, BIOLOGICAL EFFECTS, BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL,
0881 FRESHWATER, FILTRATION , CONTAMINANTS, OIL-WATER SEPARATION, PATENT,
0955 FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, WSF, GROWTH, FUEL OIL,
1093 FRESHWATER, ECOSYSTEMS, BIODEGRADATION, MICROORGANISMS, OIL SLICKS, *CONTINUOUS CULTURE,
1096 FRESHWATER, BEHAVIOR, OIL SLICKS, ICE, SOLUTION, SPILL CLEANUP,
R065 FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, REFINERIES, WASTEWATERS, INTERTIDAL ZONE, INVERTEBRATES,
0732 FUEL OIL, DETECTION, MONITORING, SEDIMENTS, SOIL, *ELECTRICAL RESISTIVITY,
0769 FUEL OIL, CHROMATOGRAPHY, BUZZARDS BAY, AROMATIC HYDROCARBONS, SEDIMENTS, MARSHES, SPECTROMETRY,
0774 FUEL OIL, CHEMICAL ANALYSIS, ALGAE, WSF, PHYTOPLANKTON, TOXICITY, GROWTH,
0779 FUEL OIL, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
0789 FUEL OIL, ABSORPTION, SPILL CLEANUP, *DIESEL OIL, *POLYURETHANE FOAM,
0851 FUEL OIL, DISPOSAL , WASTE OIL, INCINERATION, *STACK EMISSIONS,
0941 FUEL OIL, BIRDS, MORTALITY, *EMBRYOTOXICITY, *EGGS,
0946 FUEL OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, WSF, *CANCER IRRORATUS,
0955 FUEL OIL, FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, WSF, GROWTH,
0959 FUEL OIL, CRUSTACEANS, CRUDE OIL, WSF, TOXICITY, MORTALITY, *LARVAE,
0962 FUEL OIL, WSF, TOXICITY, REPRODUCTION, COPEPODS, *TIGRIOPUS JAPONICUS,
0965 FUEL OIL, CHRONIC EFFECTS, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, MOLLUSKS, UPTAKE, GROWTH, *CARBON FLUX, *MYA ARENARIA,
0972 FUEL OIL, CRUSTACEANS, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, MARSHES, RECOVERY, *UCA PUGNAX,
0974 FUEL OIL, BEHAVIOR, WSF, ZOOPLANKTON, SUBLETHAL EFFECTS, *LUCIFER FAXONI,
0979 FUEL OIL, CRUSTACEANS, AMPHIPODS, TOXICITY, *EXPERIMENTAL VARIABLES, *NEOHAUSTORIUS SCHMITZI,
0988 FUEL OIL, WSF, SUBLETHAL EFFECTS, GROWTH, REPRODUCTION, POLYCHAETES, *NEANTHES ARENACEODENTATA,
0994 FUEL OIL, UPTAKE, RELEASE, TOXICITY, MOLLUSKS, BEHAVIOR, *RESPIRATION, *MYA ARENARIA,
0995 FUEL OIL, SUBLETHAL EFFECTS, UPTAKE, RELEASE, HYDROCARBONS , MOLLUSKS, *RESPIRATION RATES, *MYA ARENARIA,
1000 FUEL OIL, FOOD WEB, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, METABOLISM, *ENZYME ACTIVITY,
1008 FUEL OIL, BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS, INVERTEBRATES, RESTORATION, RECOVERY, MARSHES,
1015 FUEL OIL, CONTAMINATION, ANTARCTICA, RECOVERY, STATISTICAL ANALYSIS,
1072 FUEL OIL, BIOMASS, BIODEGRADATION, MICROORGANISMS, PH CONTROL, *DEVIATIONS, *ALKALI CONSUMPTION,
1092 FUEL OIL, BIODEGRADATION, HYDROCARBONS , METABOLISM, LUBRICATING OIL, *PROCEEDINGS,
1105 FUEL OIL, FATE, CHROMATOGRAPHY, CANADA, BIODEGRADATION, BAYS, HYDROCARBONS , SOURCE IDENTIFICATION, *PENTACYCLIC TRITERPANES,
1109 FUEL OIL, FATE, CHEDABUCTO BAY, SEDIMENTS, INTERTIDAL ZONE, *ARROW SPILL,
R113 FUEL OIL, ENVIRONMENTAL EFFECTS, MARSHES, GROWTH, RECOVERY, MASSACHUSETTS,
1097 FUELS , EVAPORATION, CRUDE OIL, PETROLEUM PRODUCTS, MODELS, *EQUATIONS,
1163 FUELS , ENVIRONMENTAL DETERIORATION, CONTAMINANTS,
1074 FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, YEASTS, HYDROCARBONS ,
1083 FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, HYDROCARBONS , YEASTS, *REVIEW,
1088 FUNGI, BIODEGRADATION, BACTERIA, HYDROCARBONS , MICROORGANISMS, YEASTS, SOIL,
1089 FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, SOIL, HYDROCARBONS ,
R127 FUNGI, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, MARSHES, SEDIMENTS,
R128 FUNGI, EMULSIFICATION, BIODEGRADATION, YEASTS, TOXICITY, GROWTH,
0945 GASOLINE, SUBLETHAL EFFECTS, WSF, UPTAKE, *INSECTS, *OXYGEN CONSUMPTION, *AEDES AEGYPTI,
1090 GASOLINE, CONTAMINATION, BIODEGRADATION, BACTERIA, GROUNDWATER,
1162 GASOLINE, STATISTICS, TOXICITY, PETROLEUM PRODUCTS, INDUSTRIES, *TOXICOLOGICAL LABORATORY,
R058 GASOLINE, CALIFORNIA, MONITORING, WATER QUALITY, GC/MS, LAKES , *RECREATIONAL BOATING,
R075 GASOLINE, SPILL REMOVAL, SEDIMENTS, SURFACTANTS, *UNDERGROUND RECOVERY ,
0753 GC/MS, BIOGENIC HYDROCARBONS, SOURCE IDENTIFICATION, HYDROCARBONS , SEDIMENTS,
R058 GC/MS, GASOLINE, CALIFORNIA, MONITORING, WATER QUALITY, LAKES , *RECREATIONAL BOATING,
1051 GEORGES BANK, FISHERIES, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, RESOURCE MANAGEMENT,
0733 GOVERNMENT AGENCIES, EPA, ENVIRONMENTAL MANAGEMENT, MONITORING,
0853 GOVERNMENT AGENCIES, DISPOSAL , INDUSTRIES, WASTE OIL, TOXICITY,
0915 GOVERNMENT AGENCIES, RECYCLING, WASTE OIL, INDUSTRIES,
0917 GOVERNMENT AGENCIES, RECYCLING, WASTE OIL, LUBRICATING OIL, RESOURCE MANAGEMENT, US, LEGISLATION,
0923 GOVERNMENT AGENCIES, CONTINGENCY PLANNING, CANADA, SPILL CLEANUP, LEGISLATION, *ONTARIO,
1128 GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, LEGISLATION, REGULATIONS, STATE GOVERNMENTS, PORTS , TANKERS, OCS,

1143 GOVERNMENT AGENCIES, FISH, ENVIRONMENTAL PROTECTION, OIL INDUSTRY, WILDLIFE, OIL SHALE, RESOURCE MANAGEMENT,
0840 GRAVITY SEPARATION, FILTRATION , COALESCENCE, BALLAST , OIL-WATER SEPARATION, PATENT, *DEWAXING UNIT,
0859 GRAVITY SEPARATION, FILTRATION , OIL-WATER SEPARATION, SLUDGE , PATENT, WASTEWATER TREATMENT,
0886 GRAVITY SEPARATION, EQUIPMENT, OIL-WATER SEPARATION, SPILL REMOVAL, PRODUCT INFORMATION, *ENQUIP INC,
0888 GRAVITY SEPARATION, EQUIPMENT, COALESCENCE, OIL-WATER SEPARATION, PRODUCT INFORMATION,
0896 GRAVITY SEPARATION, OIL-WATER SEPARATION, MONITORING, PRODUCT INFORMATION,
0908 GRAVITY SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
0909 GRAVITY SEPARATION, EQUIPMENT, ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, PATENT,
0743 GREENLAND, SAMPLING, HYDROCARBONS , SEDIMENTS, MARINE ORGANISMS, METABOLISM,
0761 GROUNDWATER, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, WASTEWATERS,
0813 GROUNDWATER, ENVIRONMENTAL EFFECTS, DISPOSAL , MANUALS, MONITORING, *OIL SPILL DEBRIS, *LANDFILLS,
1048 GROUNDWATER, OIL INDUSTRY, OIL FIELDS, HEALTH HAZARDS, SOURCES, POLLUTION CONTROL,
1090 GROUNDWATER, GASOLINE, CONTAMINATION, BIODEGRADATION, BACTERIA,
1161 GROUNDWATER, CONTAMINATION, HYDROCARBONS , WATER QUALITY, *REVIEW,
1173 GROUNDWATER, PETROLEUM PRODUCTS, *LEACHING, *SALT DEPOSITS,
R060 GROUNDWATER, CONTAMINATION, SAMPLING, SOLID WASTES, OIL INDUSTRY, *LEACHING TEST,
R118 GROUNDWATER, CONTAMINATION, BIODEGRADATION, HYDROCARBONS , SEDIMENTS, OIL FIELDS, MARSHES,
R121 GROUNDWATER, ECONOMIC EFFECTS, DRILLING , CONTAMINATION, ANALYTICAL TECHNIQUES, RESOURCE MANAGEMENT, *ENHANCED OIL RECOVERY , *WATER RESOURCES,
0748 GROWTH, BIOASSAY, PHYTOPLANKTON, HYDROCARBONS , UPTAKE, *EXPERIMENTAL DESIGN, *BENZENE,
0774 GROWTH, FUEL OIL, CHEMICAL ANALYSIS, ALGAE, WSF, PHYTOPLANKTON, TOXICITY,
0955 GROWTH, FUEL OIL, FRESHWATER, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, WSF,
0965 GROWTH, FUEL OIL, CHRONIC EFFECTS, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, MOLLUSKS, UPTAKE, *CARBON FLUX, *MYA ARENARIA,
0969 GROWTH, CRUDE OIL, BEHAVIOR, SUBLETHAL EFFECTS, WSF, *FEEDING RATES, *MERCENARIA MERCENARIA,
0976 GROWTH, BIOLOGICAL EFFECTS, TOXICITY, HYDROCARBONS , *MUSSELS,
0983 GROWTH, CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, WSF, *MOLTING, *MESIDOTEA ENTOMON,
0985 GROWTH, FISH, CRUDE OIL, BIOASSAY, ACUTE EFFECTS, MORTALITY, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
0988 GROWTH, FUEL OIL, WSF, SUBLETHAL EFFECTS, REPRODUCTION, POLYCHAETES, *NEANTHES ARENACEODENTATA,
1085 GROWTH, BIODEGRADATION, BACTERIA, HYDROCARBONS ,
R082 GROWTH, FISH, BIOASSAY, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, PHYTOPLANKTON, WATER QUALITY,
R095 GROWTH, DEVELOPMENT , CRUSTACEANS, BEHAVIOR, *LARVAE, *HOMARUS AMERICANUS,
R100 GROWTH, FISH, DEVELOPMENT , CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, HYDROCARBONS , INVERTEBRATES,
R101 GROWTH, FOOD WEB, CORAL REEFS, HYDROCARBONS , *DRILLING MUD, UPTAKE, RELEASE, SEDIMENTATION,
R113 GROWTH, FUEL OIL, ENVIRONMENTAL EFFECTS, MARSHES, RECOVERY, MASSACHUSETTS,
R128 GROWTH, FUNGI, EMULSIFICATION, BIODEGRADATION, YEASTS, TOXICITY,
0843 GUIDELINES, CANADA, WASTEWATERS, REFINERIES, POLLUTION PREVENTION, OIL INDUSTRY, REGULATIONS,
1013 GUIDELINES, RESTORATION, MANUALS, WILDLIFE,
1139 GUIDELINES, COASTS, OIL SPILLS, ONSHORE IMPACTS, *SHORELINE TYPE CLASSIFICATION, *CASE STUDIES,
1142 GUIDELINES, COASTAL ZONE MANAGEMENT, CONSERVATION, MANUALS, INDUSTRIES,
1147 GUIDELINES, ECONOMICS, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, SHIPS,
1148 GUIDELINES, ECONOMICS, DESIGN-ENGINEERING, IMCO, TANKERS, POLLUTION PREVENTION,
R106 GUIDELINES, BIRDS, SUBLETHAL EFFECTS, TOXICITY,
R125 GUIDELINES, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OCS, MARINE ORGANISMS, INTERTIDAL ZONE, BIOINDICATORS, ALASKA,
R149 GUIDELINES, EPA, COST ANALYSIS, API, MODELS, STATISTICAL ANALYSIS, REFINERIES, WASTEWATERS,
1062 GULF OF ALASKA, ENVIRONMENTAL EFFECTS, CRUDE OIL, BLM, BEAUFORT SEA, OCS, OFFSHORE DEVELOPMENT,
0750 GULF OF MEXICO, CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, *CRASSOSTREA VIRGINICA,
1060 GULF OF MEXICO, DEEPWATER PORTS, BASELINE STUDIES, AROMATIC HYDROCARBONS, SEAWATER, SAMPLING, SPECTROSCOPY,
1067 GULF OF MEXICO, ENVIRONMENTAL EFFECTS, DEEPWATER PORTS,
R116 GULF OF MEXICO, BIOASSAY, TOXICITY, *DRILLING MUDS, MARINE ORGANISMS,
R119 GULF OF MEXICO, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, CONTAMINANTS, OIL FIELDS,
R124 GULF OF MEXICO, FISHERIES, BASELINE STUDIES, *MACKEREL,
1021 HABITATS, ENVIRONMENTAL EFFECTS, COASTS, COASTAL ZONE MANAGEMENT, BIOLOGICAL EFFECTS, SPILL CLEANUP,
R114 HABITATS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIRDS, OIL TRANSPORT, PIPELINES, ALASKA, *WETLAND RESOURCES,

R115 HABITATS, FOOD WEB, DEVELOPMENT , ARCTIC, ANIMALS, MARINE MAMMALS, PIPELINES,
0785 HARBORS, EQUIPMENT, BLACK SEA, SPILL REMOVAL, ICE,
1038 HEALTH HAZARDS, DISPOSAL , CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, *TRACE METALS, *ASPHALT,
1041 HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, CRUDE OIL, CONTAMINANTS, WASTE OIL, PETROLEUM PRODUCTS, *TRACE METALS,
1048 HEALTH HAZARDS, GROUNDWATER, OIL INDUSTRY, OIL FIELDS, SOURCES, POLLUTION CONTROL,
1110 HEALTH HAZARDS, DISTRIBUTION, CONTAMINANTS, CARCINOGENS, PAH, SOURCES, METABOLISM,
R081 HEALTH HAZARDS, CONTAMINANTS, ANIMALS, WASTEWATERS, TOXICITY, PAH,
R091 HEALTH HAZARDS, CARCINOGENS, AROMATIC HYDROCARBONS, MARINE ORGANISMS, TOXICITY, *PNA,
0743 HYDROCARBONS , GREENLAND, SAMPLING, SEDIMENTS, MARINE ORGANISMS, METABOLISM,
0746 HYDROCARBONS , SPECTROSCOPY, SEAWATER,
0747 HYDROCARBONS , CHROMATOGRAPHY, BENTHOS, SEDIMENTS, INTERTIDAL ZONE, RELEASE, *RECRUITMENT,
0748 HYDROCARBONS , GROWTH, BIOASSAY, PHYTOPLANKTON, UPTAKE, *EXPERIMENTAL DESIGN, *BENZENE,
0751 HYDROCARBONS , CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, MARINE ORGANISMS,
0752 HYDROCARBONS , CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SAMPLING, *TRACE LEVELS,
0753 HYDROCARBONS , GC/MS, BIOGENIC HYDROCARBONS, SOURCE IDENTIFICATION, SEDIMENTS,
0756 HYDROCARBONS , CHEMICAL ANALYSIS, SEAWATER,
0764 HYDROCARBONS , CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SAMPLING, SEDIMENTS, SEAWATER,
0772 HYDROCARBONS , CHRONIC EFFECTS, BIOGENIC HYDROCARBONS, SEDIMENTS, SOURCES, NARRAGANSETT BAY, *RHODE ISLAND SOUND,
0776 HYDROCARBONS , DISTRIBUTION, SAMPLING, SEAWATER, SEDIMENTS, MARINE ORGANISMS,
0777 HYDROCARBONS , CHROMATOGRAPHY, *UV ABSORPTION, MONITORING, MARINE ORGANISMS,
0847 HYDROCARBONS , CONTAMINATION, WASTEWATER TREATMENT, PH CONTROL, REFINERIES, *COAGULATION,
0876 HYDROCARBONS , WASTEWATER TREATMENT, SAMPLING, OIL-WATER SEPARATION,
0877 HYDROCARBONS , FATE, ESTUARIES, COASTS, WASTEWATERS, SEDIMENTATION, RIVERS, NARRAGANSETT BAY, *PROVIDENCE RIVER,
0878 HYDROCARBONS , FLOCCULATION, CONTAMINANTS, WASTEWATER TREATMENT, PAH,
0892 HYDROCARBONS , AROMATIC HYDROCARBONS, OIL-WATER SEPARATION, PATENT, *MEMBRANES,
0903 HYDROCARBONS , EQUIPMENT, OIL-WATER SEPARATION, PATENT,
0942 HYDROCARBONS , CHRONIC EFFECTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, SEDIMENTS, RECCVERY,
0948 HYDROCARBONS , CHRONIC EFFECTS, MOLLUSKS, UPTAKE, RELEASE, RIVERS, *MERCENARIA MERCENARIA,
0952 HYDROCARBONS , ARCTIC, AMPHIPODS, TOXICITY, OIL SPILLS,
0953 HYDROCARBONS , CRUDE OIL, BACTERIA, TOXICITY, WSF, WASTE OIL, MOLLUSKS, SUBLETHAL EFFECTS, MORTALITY,
0963 HYDROCARBONS , RELEASE, MARINE ORGANISMS,
0964 HYDROCARBONS , BIOLOGICAL EFFECTS, ALGAE, WSF, MARINE ORGANISMS, INVERTEBRATES, *PROCEEDINGS,
0968 HYDROCARBONS , BIOLOGICAL EFFECTS, BACTERIA, *CO2 FIXATION,
0971 HYDROCARBONS , FATE, DISTRIBUTION, CARCINOGENS, PAH, METABOLISM, MARINE ORGANISMS, *PROCEEDINGS, *NEOPLASIA,
0976 HYDROCARBONS , GROWTH, BIOLOGICAL EFFECTS, TOXICITY, *MUSSELS,
0986 HYDROCARBONS , CRUDE OIL, UPTAKE, PAH, INVERTEBRATES, SEDIMENTS, PRUDHOE BAY,
0993 HYDROCARBONS , UPTAKE, INVERTEBRATES, BIOINDICATORS, MEDITERRANEAN SEA, *MYTILUS GALLOPROVINCIALIS,
0995 HYDROCARBONS , FUEL OIL, SUBLETHAL EFFECTS, UPTAKE, RELEASE, MOLLUSKS, *RESPIRATION RATES, *MYA ARENARIA,
0998 HYDROCARBONS , CHEDABUCTO BAY, BIOMASS, BIOLOGICAL EFFECTS, INTERTIDAL ZONE, SEDIMENTS,
1001 HYDROCARBONS , CONTAMINATION, SUBLETHAL EFFECTS,
1025 HYDROCARBONS , CONTAMINATION, BIOLOGICAL EFFECTS, BIODEGRADATION, MARINE ORGANISMS, *CONFERENCE SUMMARY,
1028 HYDROCARBONS , CONTAMINATION, BEACHES, SEAWATER, SOIL, PETROLEUM PRODUCTS, USSR,
1040 HYDROCARBONS , FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, UPTAKE, METABOLISM, *PROCEEDINGS,
1061 HYDROCARBONS , BASELINE STUDIES, SAMPLING, PUGET SOUND, MODELS,
1074 HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, YEASTS,
1075 HYDROCARBONS , DISTRIBUTION, BIODEGRADATION, BACTERIA, JAPAN, *BISAN SETO,
1076 HYDROCARBONS , BIODEGRADATION, BACTERIA, ARCTIC OCEAN, MICROORGANISMS,
1080 HYDROCARBONS , DISPERSANTS, CRUDE OIL, BIODEGRADATION, MICROORGANISMS, TAR,
1082 HYDROCARBONS , CRUSTACEANS, BIODEGRADATION, METABOLISM, *CALLINECTES SAPIDUS, POLYCHAETES, *NEREIS SP., *ARYL HYDROCARBON HYDROXYLASE,
1083 HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, YEASTS, *REVIEW,
1085 HYDROCARBONS , GROWTH, BIODEGRADATION, BACTERIA,
1088 HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, YEASTS, SOIL,
1089 HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, MICROORGANISMS, SOIL,
1092 HYDROCARBONS , FUEL OIL, BIODEGRADATION, METABOLISM, LUBRICATING OIL, *PROCEEDINGS,
1102 HYDROCARBONS , FATE, DISTRIBUTION, CHEMICAL ANALYSIS, BIODEGRADATION, SEDIMENTS, SEAWATER, *PROCEEDINGS,
1104 HYDROCARBONS , FOOD WEB, BIODEGRADATION, PAH, SOURCES, UPTAKE, RELEASE, MARINE ORGANISMS,

1105 HYDROCARBONS , FUEL OIL, FATE, CHROMATOGRAPHY, CANADA, BIODEGRADATION, BAYS, SOURCE IDENTIFICATION, *PENTACYCLIC TRITERPANES,
1116 HYDROCARBONS , FATE, MODELS, SEA SURFACE,
1118 HYDROCARBONS , CONTAMINANTS, SOURCES, UPTAKE, MARINE ORGANISMS,
1161 HYDROCARBONS , GROUNDWATER, CONTAMINATION, WATER QUALITY, *REVIEW,
R067 HYDROCARBONS , DELAWARE, CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, OXIDATION, SEDIMENTS, UPTAKE, *CHARACTERIZATION,
R068 HYDROCARBONS , CHEMICAL ANALYSIS, OCEANS, MARINE ORGANISMS, *TRACE GASES,
R069 HYDROCARBONS , DETECTION, ANALYTICAL TECHNIQUES, USN, *OIL/GREASE IN WATER,
R070 HYDROCARBONS , ANALYTICAL TECHNIQUES, SEAWATER, SEDIMENTS, *ANIMAL TISSUES,
R092 HYDROCARBONS , FISH, SUBLETHAL EFFECTS, METABOLISM, *TEMPERATURE,
R093 HYDROCARBONS , FISH, SUBLETHAL EFFECTS, METABOLISM, *TEMPERATURE,
R096 HYDROCARBONS , ESTUARIES, ENVIRONMENTAL EFFECTS, BIOGENIC HYDROCARBONS, ADSORPTION, SEDIMENTATION, MONITORING,
R100 HYDROCARBONS , GROWTH, FISH, DEVELOPMENT , CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, INVERTEBRATES,
R101 HYDROCARBONS , GROWTH, FOOD WEB, CORAL REEFS, *DRILLING MUD, UPTAKE, RELEASE, SEDIMENTATION,
R104 HYDROCARBONS , CONTAMINANTS, MARINE ORGANISMS, MOLLUSKS, *TUMORS,
R105 HYDROCARBONS , FISH, CHRONIC EFFECTS, METABOLISM,
R109 HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES, MARINE ORGANISMS, TOXICITY, SUBARCTIC REGIONS, NOAA,
R118 HYDROCARBONS , GROUNDWATER, CONTAMINATION, BIODEGRADATION, SEDIMENTS, OIL FIELDS, MARSHES,
R123 HYDROCARBONS , ENVIRONMENTAL MANAGEMENT, DEVELOPMENT , BASELINE STUDIES, MARINE ORGANISMS, MODELS, PUGET SOUND,
R139 HYDROCARBONS , CHEMICAL EFFECTS, SOLUBILITY, SEAWATER, USN,
R142 HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BENTHOS, SEAWATER, SEDIMENTS, SARGASSO SEA, *TRANSPORT ,
R145 HYDROCARBONS , FATE, BIODEGRADATION, MODELS, MARINE ORGANISMS, OIL SLICKS,
0785 ICE, HARBORS, EQUIPMENT, BLACK SEA, SPILL REMOVAL,
0807 ICE, EQUIPMENT, CANADA, SPILL CLEANUP, RIVERS, SKIMMERS,
0817 ICE, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SPILL CONTAINMENT,
1096 ICE, FRESHWATER, BEHAVIOR, OIL SLICKS, SOLUTION, SPILL CLEANUP,
R129 ICE, COASTS, BIOLOGICAL EFFECTS, BIODEGRADATION, MICROORGANISMS, ALASKA,
0911 ILLINOIS, WASTE OIL, LEGISLATION, RESOURCE MANAGEMENT, *PROCEEDINGS,
0821 IMCO, CRUDE OIL WASHING, TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, *LOAD-ON-TOP,
0822 IMCO, OCEANS, RESOURCE MANAGEMENT, TANKERS, REGULATIONS, TORREY CANYON SPILL,
0824 IMCO, AMOCO CADIZ SPILL, TANKERS, INTERNATIONAL CONVENTIONS, SEGREGATED BALLAST, POLLUTION PREVENTION, SAFETY,
1126 IMCO, LEGISLATION, REGULATIONS, TANKERS, US, POLLUTION PREVENTION,
1135 IMCO, TANKERS, INTERNATIONAL CONVENTIONS, SEGREGATED BALLAST, POLLUTION PREVENTION,
1145 IMCO, CRUDE OIL WASHING, TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION,
1146 IMCO, CRUDE OIL WASHING, AMOCO CADIZ SPILL, TANKERS, INTERNATIONAL AGREEMENTS, SEGREGATED BALLAST, SAFETY,
1148 IMCO, GUIDELINES, ECONOMICS, DESIGN-ENGINEERING, TANKERS, POLLUTION PREVENTION,
1149 IMCO, CRUDE OIL WASHING, TANKERS, INTERNATIONAL CONVENTIONS, SEGREGATED BALLAST, POLLUTION PREVENTION,
0734 INCINERATION, BALLAST , MONITORING, OIL-WATER SEPARATION, SHIPS, POLLUTION PREVENTION, WASTEWATERS,
0792 INCINERATION, EQUIPMENT, CANADA, SPILL DISPOSAL,
0850 INCINERATION, ABSORPTION, *ATOMIZATION, WASTEWATER, WASTE OIL, PATENT,
0851 INCINERATION, FUEL OIL, DISPOSAL , WASTE OIL, *STACK EMISSIONS,
0867 INCINERATION, FLOTATION, FILTRATION , WASTEWATER TREATMENT, OIL-WATER SEPARATION, SHIPS,
1077 INCINERATION, DISPOSAL , BIODEGRADATION, SLUDGE , REFINERIES, SOIL, *LAND FARMING,
0826 INDUSTRIES, ADSORPTION, WASTEWATERS, OIL-WATER SEPARATION, *AGENT NT75,
0830 INDUSTRIES, EQUIPMENT, EMULSIONS, ECONOMICS, WASTE OIL TREATMENT, REFINING, *TECHNOLOGY REVIEW,
0831 INDUSTRIES, WASTEWATER TREATMENT, *PROCEEDINGS,
0837 INDUSTRIES, DISPOSAL , WASTE OIL, RECYCLING,
0842 INDUSTRIES, WASTEWATER TREATMENT, REFINING, PETROCHEMICALS, MANUALS,
0845 INDUSTRIES, REFINERIES, PETROCHEMICALS, WASTEWATER TREATMENT,
0853 INDUSTRIES, GOVERNMENT AGENCIES, DISPOSAL , WASTE OIL, TOXICITY,
0854 INDUSTRIES, BALLAST , WASTEWATER TREATMENT, TANKERS, *REVIEW,
0866 INDUSTRIES, WASTEWATER TREATMENT, ULTRAFILTRATION, OIL-WATER SEPARATION, *POROUS GLASS MEMBRANE,
0912 INDUSTRIES, CRANKCASE OIL, WASTE OIL, RECYCLING, REUSE, LEGISLATION, *PROCEEDINGS,
0915 INDUSTRIES, GOVERNMENT AGENCIES, RECYCLING, WASTE OIL,
1030 INDUSTRIES, ENVIRONMENTAL EFFECTS, OIL SPILLS, OCEANS,
1034 INDUSTRIES, BOOK REVIEW, WATER QUALITY, SOURCES, LAKES , OCEANS,
1142 INDUSTRIES, GUIDELINES, COASTAL ZONE MANAGEMENT, CONSERVATION, MANUALS,
1162 INDUSTRIES, GASOLINE, STATISTICS, TOXICITY, PETROLEUM PRODUCTS, *TOXICOLOGICAL LABORATORY,
1171 INDUSTRIES, ENVIRONMENTAL EFFECTS, PRODUCTION , PETROLEUM PRODUCTS, *IMPACT MAPS,

R083 INDUSTRIES, WASTEWATER TREATMENT, REFINING, *LAND APPLICATION,
R134 INLAND, CRUDE OIL, BIODEGRADATION, MICROORGANISMS, SOIL, SUBARCTIC REGIONS,
1045 INTERNATIONAL AGREEMENTS, OFFSHORE DEVELOPMENT, OCS, OIL TRANSPORT, LAW ENFORCEMENT, POLLUTION CONTROL,
1134 INTERNATIONAL AGREEMENTS, LAW ENFORCEMENT, TANKERS, US, *LAW OF THE SEA,
1136 INTERNATIONAL AGREEMENTS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, LEGISLATION, REGULATIONS, *LAW OF THE SEA,
1146 INTERNATIONAL AGREEMENTS, IMCO, CRUDE OIL WASHING, AMOCO CADIZ SPILL, TANKERS, SEGREGATED BALLAST, SAFETY,
1150 INTERNATIONAL AGREEMENTS, CONTINGENCY PLANNING, COMPENSATION, INTERNATIONAL CONVENTIONS, US, POLLUTION PREVENTION, LIABILITY,
0824 INTERNATIONAL CONVENTIONS, IMCO, AMOCO CADIZ SPILL, TANKERS, SEGFEGATED BALLAST, POLLUTION PREVENTION, SAFETY,
1135 INTERNATIONAL CONVENTIONS, IMCO, TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION,
1136 INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, POLLUTION PREVENTION, LEGISLATION, REGULATIONS, *LAW OF THE SEA,
1147 INTERNATIONAL CONVENTIONS, GUIDELINES, ECONOMICS, POLLUTION PREVENTION, SHIPS,
1149 INTERNATIONAL CONVENTIONS, IMCO, CRUDE OIL WASHING, TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION,
1150 INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, CONTINGENCY PLANNING, COMPENSATION, US, POLLUTION PREVENTION, LIABILITY,
0726 INTERTIDAL ZONE, FRANCE, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL, MORTALITY, MARINE ORGANISMS,
0747 INTERTIDAL ZONE, HYDROCARBONS , CHROMATOGRAPHY, BENTHOS, SEDIMENTS, RELEASE, *RECRUITMENT,
0954 INTERTIDAL ZONE, ECHINODERMS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, UPTAKE, WEATHERING, *GENERAL M.C. MEIGS SPILL,
0975 INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, PHYTOPLANKTON,
0990 INTERTIDAL ZONE, FLORIDA SPILL, BUZZARDS BAY, BENTHOS, MARINE ORGANISMS, SEDIMENTS, STATISTICAL ANALYSIS,
0998 INTERTIDAL ZONE, HYDROCARBONS , CHEDABUCTO BAY, BIOMASS, BIOLOGICAL EFFECTS, SEDIMENTS,
1012 INTERTIDAL ZONE, ECOSYSTEMS, CHRONIC EFFECTS, RECOVERY, *SYMPOSIUM SUMMARY,
1014 INTERTIDAL ZONE, CHRONIC EFFECTS, BALTIC SEA, RECOVERY, MARINE ORGANISMS, *FUCUS VESICULOSUS, *IRINI SPILL,
1017 INTERTIDAL ZONE, FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, RECOVERY, *PROCEEDINGS,
1019 INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, RECOVERY,
1024 INTERTIDAL ZONE, BIOLOGICAL EFFECTS, SOURCES, SPILL CLEANUP, PACIFIC OCEAN,
1064 INTERTIDAL ZONE, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, PLANKTON , ALASKA,
1096 INTERTIDAL ZONE, DISPERSIONS, WEATHERING, *MECHANICAL ENERGY,
1109 INTERTIDAL ZONE, FUEL OIL, FATE, CHEDABUCTO BAY, SEDIMENTS, *ARROW SPILL,
1113 INTERTIDAL ZONE, BIODEGRADATION, AROMATIC HYDROCARBONS, SAMPLING, MICROORGANISMS, YUGOSLAVIA,
R065 INTERTIDAL ZONE, FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, REFINERIES, WASTEWATERS, INVERTEBRATES,
R107 INTERTIDAL ZONE, CHRONIC EFFECTS, MOLLUSKS, NATURAL SEEPAGE, SEDIMENTS, SAMPLING,
R125 INTERTIDAL ZONE, GUIDELINES, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OCS, MARINE ORGANISMS, BIOINDICATORS, ALASKA,
0943 INVERTEBRATES, CONTAMINANTS, METABOLISM, MARINE ORGANISMS, VERTEBRATES , *BIOTRANSFORMATIONS,
0964 INVERTEBRATES, HYDROCARBONS , BIOLOGICAL EFFECTS, ALGAE, WSF, MARINE ORGANISMS, *PROCEEDINGS,
0986 INVERTEBRATES, HYDROCARBONS , CRUDE OIL, UPTAKE, PAH, SEDIMENTS, PRUDHOE BAY,
0993 INVERTEBRATES, HYDROCARBONS , UPTAKE, BIOINDICATORS, MEDITERRANEAN SEA, *MYTILUS GALLOPROVINCIALIS,
1008 INVERTEBRATES, FUEL OIL, BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS, RESTORATION, RECOVERY, MARSHES,
1069 INVERTEBRATES, CRUDE OIL, BIODEGRADATION, BENTHOS, ARCTIC, MICROORGANISMS, MORTALITY, *RECOLONIZATION,
R065 INVERTEBRATES, INTERTIDAL ZONE, FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, REFINERIES, WASTEWATERS,
R090 INVERTEBRATES, FISH, CONTAMINATION, CHRONIC EFFECTS, MARSHES, BIOINDICATORS,
R100 INVERTEBRATES, HYDROCARBONS , GROWTH, FISH, DEVELOPMENT , CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR,
0723 IRELAND, COASTS, STATISTICS,
1137 ISRAEL, COASTS, RESOURCE MANAGEMENT, POLLUTION PREVENTION, MEDITERRANEAN SEA,
1075 JAPAN, HYDROCARBONS , DISTRIBUTION, BIODEGRADATION, BACTERIA, *BISAN SETO,
1123 LABRADOR SEA, DRIFT, MODELS, OIL SLICKS, OFFSHORE DRILLING,
1034 LAKES , INDUSTRIES, BOOK REVIEW, WATER QUALITY, SOURCES, OCEANS,
1055 LAKES , CANADA, BIOGENIC HYDROCARBONS, SAMPLING, PAH,
1099 LAKES , EVAPORATION, CRUDE OIL, OIL SLICKS, SPREADING, MOVEMENT,
R058 LAKES , GC/MS, GASOLINE, CALIFORNIA, MONITORING, WATER QUALITY, *RECREATIONAL BOATING,
1045 LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, OFFSHORE DEVELOPMENT, OCS, OIL TRANSPORT, POLLUTION CONTROL,

1134 LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, TANKERS, US, *LAW OF THE SEA,
0713 LEAKAGE, PIPELINES, WASTEWATERS, REFINERIES, *CONCAWE,
0935 LEAKAGE, EQUIPMENT, PRODUCT INFORMATION, MONITORING, PIPELINES, OIL TANKS, *ACOUSTIC EMISSION MONITOR,
R077 LEAKAGE, EQUIPMENT, DESIGN-ENGINEERING, SURVEILLANCE, POLLUTION CONTROL, SAFETY, *REMOTE CONTROL HOVERCRAFT,
0736 LEGISLATION, EUROPE, REMOTE SENSING, MONITORING, SURVEILLANCE, *SATELLITES,
0802 LEGISLATION, BOOMS, OIL SPILLS, SPILL CLEANUP, SKIMMERS, POLLUTION PREVENTION,
0911 LEGISLATION, ILLINOIS, WASTE OIL, RESOURCE MANAGEMENT, *PROCEEDINGS,
0912 LEGISLATION, INDUSTRIES, CRANKCASE OIL, WASTE OIL, RECYCLING, REUSE, *PROCEEDINGS,
0917 LEGISLATION, GOVERNMENT AGENCIES, RECYCLING, WASTE OIL, LUBRICATING OIL, RESOURCE MANAGEMENT, US,
0923 LEGISLATION, GOVERNMENT AGENCIES, CONTINGENCY PLANNING, CANADA, SPILL CLEANUP, *ONTARIO,
0932 LEGISLATION, POLLUTION CONTROL, WASTEWATER TREATMENT, REFINING, US,
1037 LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS, OIL SPILLS, OCS,
1126 LEGISLATION, IMCO, REGULATIONS, TANKERS, US, POLLUTION PREVENTION,
1127 LEGISLATION, TOXICITY, POLLUTION CONTROL, *FEDERAL WATER POLLUTION CONTROL ACT,
1128 LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, REGULATIONS, STATE GOVERNMENTS, PORTS , TANKERS, OCS,
1129 LEGISLATION, US, OIL DISCHARGES, OIL SPILLS, LIABILITY, *WATER POLLUTION CONTROL ACT,
1130 LEGISLATION, US, POLLUTION CONTROL, LIABILITY, *CLEAN WATER ACT 1977,
1131 LEGISLATION, EPA, REFINERIES, WASTEWATER TREATMENT, *CLEAN WATER ACT 1977,
1132 LEGISLATION, NOAA, *RESEARCH MANAGEMENT,
1133 LEGISLATION, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, OCS, LIABILITY, SANTA BARBARA CHANNEL,
1136 LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, POLLUTION PREVENTION, REGULATIONS, *LAW OF THE SEA,
1138 LEGISLATION, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORTH SEA, NORWAY, UK,
1129 LIABILITY, LEGISLATION, US, OIL DISCHARGES, OIL SPILLS, *WATER POLLUTION CONTROL ACT,
1130 LIABILITY, LEGISLATION, US, POLLUTION CONTROL, *CLEAN WATER ACT 1977,
1133 LIABILITY, LEGISLATION, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, OCS, SANTA BARBARA CHANNEL,
1150 LIABILITY, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, CONTINGENCY PLANNING, COMPENSATION, US, POLLUTION PREVENTION,
1058 LOUISIANA, FEA, EIS, CRUDE OIL, STORAGE, *SALT DOME, *STRATEGIC PETROLEUM RESERVE,
R117 LOUISIANA, ESTUARIES, ENVIRONMENTAL EFFECTS, DRILLING , PHYTOPLANKTON, *CARBON FLUX,
R120 LOUISIANA, DEVELOPMENT , COASTS, OIL INDUSTRY,
0832 LUBRICATING OIL, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, PH CONTROL,
0834 LUBRICATING OIL, FLOTATION, EQUIPMENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
0872 LUBRICATING OIL, DISPOSAL , CARCINOGENS, AROMATIC HYDROCARBONS, WASTE OIL, REFINING, RECLAMATION,
0874 LUBRICATING OIL, OIL-WATER SEPARATION, *OIL REMOVAL, WASTE OIL TREATMENT, PATENT,
0885 LUBRICATING OIL, COST ANALYSIS, BIOLOGICAL EFFECTS, OIL-WATER SEPARATION,
0906 LUBRICATING OIL, ADSORPTION, OIL-WATER SEPARATION, PATENT,
0913 LUBRICATING OIL, RECLAMATION, RECYCLING, SOLVENTS,
0917 LUBRICATING OIL, LEGISLATION, GOVERNMENT AGENCIES, RECYCLING, WASTE OIL, RESOURCE MANAGEMENT, US,
0937 LUBRICATING OIL, DISPOSAL , POLLUTION PREVENTION, OIL SLICKS, POLLUTION CONTROL, REUSE,
1092 LUBRICATING OIL, HYDROCARBONS , FUEL OIL, BIODEGRADATION, METABOLISM, *PROCEEDINGS,
0966 MAINE, CHRONIC EFFECTS, OIL SPILLS, MOLLUSKS, *CLAMS, MORTALITY, SEDIMENTS,
1112 MAINE, FATE, CHEMICAL ANALYSIS, WEATHERING, SEDIMENTS, SAMPLING, *MYA ARENARIA,
0782 MANUALS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SAMPLING, USCG, SAFETY, WEATHERING,
0813 MANUALS, GROUNDWATER, ENVIRONMENTAL EFFECTS, DISPOSAL , MONITORING, *OIL SPILL DEBRIS, *LANDFILLS,
0842 MANUALS, INDUSTRIES, WASTEWATER TREATMENT, REFINING, PETROCHEMICALS,
0920 MANUALS, API, PERSONNEL TRAINING, STATISTICS, OIL SPILLS,
0921 MANUALS, DESIGN-ENGINEERING, PERSONNEL TRAINING, PLATFORMS, TANKERS, SHIPS, OIL TRANSPORT, SAFETY,
1009 MANUALS, BIRDS, RESTORATION, OIL SLICKS,
1013 MANUALS, GUIDELINES, RESTORATION, WILDLIFE,
1142 MANUALS, INDUSTRIES, GUIDELINES, COASTAL ZONE MANAGEMENT, CONSERVATION,
R076 MANUALS, ENVIRONMENTAL PROTECTION, DISPERSANTS, BIRDS, SPILL REMOVAL, POLLUTION PREVENTION, SAFETY,
1052 MARINE MAMMALS, COASTS, CANADA, BASELINE STUDIES, ARCTIC OCEAN,
1063 MARINE MAMMALS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, ALASKA,
R115 MARINE MAMMALS, HABITATS, FOOD WEB, DEVELOPMENT , ARCTIC, ANIMALS, PIPELINES,
0711 MARINE ORGANISMS, FRANCE, COASTS, BIOLOGICAL EFFECTS, AMOCO CADIZ SPILL, ACUTE EFFECTS,
0722 MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BEACH CLEANUP, AMOCC CADIZ SPILL, MARSHES,
0726 MARINE ORGANISMS, INTERTIDAL ZONE, FRANCE, ENVIRONMENTAL EFFECTS, AMOCC CADIZ SPILL, MORTALITY,
0742 MARINE ORGANISMS, CRUDE OIL, CHEMICAL ANALYSIS, BENTHOS, AROMATIC HYDROCARBONS, SAMPLING, NORWAY,

0763 MARINE ORGANISMS, HYDROCARBONS , GREENLAND, SAMPLING, SEDIMENTS, METABOLISM,
0751 MARINE ORGANISMS, HYDROCARBONS , CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY,
0776 MARINE ORGANISMS, HYDROCARBONS , DISTRIBUTION, SAMPLING, SEAWATER, SEDIMENTS,
0777 MARINE ORGANISMS, HYDROCARBONS , CHROMATOGRAPHY, *UV ABSORPTION, MONITORING,
0942 MARINE ORGANISMS, HYDROCARBONS , CHRONIC EFFECTS, BIOLOGICAL EFFECTS, SEDIMENTS, RECOVERY,
0943 MARINE ORGANISMS, INVERTEBRATES, CONTAMINANTS, METABOLISM, VERTEBRATES , *BIOTRANSFORMATIONS,
0949 MARINE ORGANISMS, CRUSTACEANS, CONTAMINANTS, MORTALITY, *LETHAL CONCENTRATION, *DAPHNIA MAGNA,
0951 MARINE ORGANISMS, TOXICITY, *INNOCUOUS OIL LEVEL, *REVIEW,
0963 MARINE ORGANISMS, HYDROCARBONS , RELEASE,
0964 MARINE ORGANISMS, INVERTEBRATES, HYDROCARBONS , BIOLOGICAL EFFECTS, ALGAE, WSF, *PROCEEDINGS,
0971 MARINE ORGANISMS, HYDROCARBONS , FATE, DISTRIBUTION, CARCINOGENS, PAH, METABOLISM, *PROCEEDINGS, *NEOPLASIA,
0990 MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, BUZZARDS BAY, BENTHOS, SEDIMENTS, STATISTICAL ANALYSIS,
1014 MARINE ORGANISMS, INTERTIDAL ZONE, CHRONIC EFFECTS, BALTIC SEA, RECOVERY, *FUCUS VESICULOSUS, *IRINI SPILL,
1016 MARINE ORGANISMS, DISPERSANTS, BEACH CLEANUP, RECOVERY, *RECOLONIZATION, SHORELINES, TORREY CANYON SPILL, UK,
1025 MARINE ORGANISMS, HYDROCARBONS , CONTAMINATION, BIOLOGICAL EFFECTS, BIODEGRADATION, *CONFERENCE SUMMARY,
1026 MARINE ORGANISMS, DETECTION, BIOLOGICAL EFFECTS, *REVIEW,
1039 MARINE ORGANISMS, ESTUARIES, BIODEGRADATION, MARSHES, SUBLETHAL EFFECTS, MICROORGANISMS, *PROCEEDINGS,
1060 MARINE ORGANISMS, HYDROCARBONS , FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, UPTAKE, METABOLISM, *PROCEEDINGS,
1053 MARINE ORGANISMS, DISTRIBUTION, BIOGENIC HYDROCARBONS, BASELINE STUDIES, SEDIMENTS, MEXICO , *N-PARAFFINS,
1076 MARINE ORGANISMS, FOOD WEB, BIODEGRADATION, ACTIVATED SLUDGE, TOXICITY, WASTEWATERS, YEASTS,
1084 MARINE ORGANISMS, BIODEGRADATION, AROMATIC HYDROCARBONS, METABOLISM, OXIDATION, *ENZYME SYSTEMS,
1106 MARINE ORGANISMS, HYDROCARBONS , FOOD WEB, BIODEGRADATION, PAH, SOURCES, UPTAKE, RELEASE,
1111 MARINE ORGANISMS, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, OFFSHORE DRILLING, SHORELINES,
1116 MARINE ORGANISMS, HYDROCARBONS , CONTAMINANTS, SOURCES, UPTAKE,
8068 MARINE ORGANISMS, HYDROCARBONS , CHEMICAL ANALYSIS, OCEANS, *TRACE GASES,
8080 MARINE ORGANISMS, DISPERSANTS, BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY,
8091 MARINE ORGANISMS, HEALTH HAZARDS, CARCINOGENS, AROMATIC HYDROCARBONS, TOXICITY, *PNA,
8103 MARINE ORGANISMS, FOOD WEB, COASTS, BIOLOGICAL EFFECTS, BIOINDICATORS, *MYTILUS EDULIS,
8104 MARINE ORGANISMS, HYDROCARBONS , CONTAMINANTS, MOLLUSKS, *TUMORS,
8109 MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES, TOXICITY, SUBARCTIC REGIONS, NOAA,
8116 MARINE ORGANISMS, GULF OF MEXICO, BIOASSAY, TOXICITY, *DRILLING MUDS,
8123 MARINE ORGANISMS, HYDROCARBONS , ENVIRONMENTAL MANAGEMENT, DEVELOPMENT , BASELINE STUDIES, MODELS, PUGET SOUND,
8125 MARINE ORGANISMS, INTERTIDAL ZONE, GUIDELINES, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OCS, BIOINDICATORS, ALASKA,
8145 MARINE ORGANISMS, HYDROCARBONS , FATE, BIODEGRADATION, MODELS, OIL SLICKS,
0722 MARSHES, MARINE ORGANISMS, FRANCE, FISHERIES, ENVIRONMENTAL EFFECTS, COASTS, BEACH CLEANUP, AMOCO CADIZ SPILL,
0768 MARSHES, FUEL OIL, CHROMATOGRAPHY, BUZZARDS BAY, AROMATIC HYDROCARBONS, SEDIMENTS, SPECTROMETRY,
0961 MARSHES, ESTUARIES, BIOLOGICAL EFFECTS, BIODEGRADATION, BACTERIA, MICROORGANISMS,
0972 MARSHES, FUEL OIL, CRUSTACEANS, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, RECOVERY, *UCA PUGNAX,
1008 MARSHES, INVERTEBRATES, FUEL OIL, BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS, RESTORATION, RECOVERY,
1039 MARSHES, MARINE ORGANISMS, ESTUARIES, BIODEGRADATION, SUBLETHAL EFFECTS, MICROORGANISMS, *PROCEEDINGS,
[illegible] MARSHES, INVERTEBRATES, FISH, CONTAMINATION, CHRONIC EFFECTS, BIOINDICATORS,
[illegible] MARSHES, CRUDE OIL, BIOLOGICAL EFFECTS, SEDIMENTS, PLANTS, *NITROGEN FLUX, *SPARTINA ALTERNIFLORA,
[illegible] MARSHES, FOOD WEB, ESTUARIES, CRUDE OIL, CHEMICAL EFFECTS, ACUTE EFFECTS, RECOVERY,
[illegible] MARSHES, ENVIRONMENTAL PROTECTION, SHORELINES, RESTORATION, *SURFACE TREATMENT AGENTS,
[illegible] MARSHES, GROWTH, FUEL OIL, ENVIRONMENTAL EFFECTS, RECOVERY, MASSACHUSETTS,
[illegible] MARSHES, HYDROCARBONS , GROUNDWATER, CONTAMINATION, BIODEGRADATION, SEDIMENTS, OIL FIELDS,
[illegible] MARSHES, FUNGI, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, SEDIMENTS,
[illegible] MASSACHUSETTS, MARSHES, GROWTH, FUEL OIL, ENVIRONMENTAL EFFECTS, RECOVERY,
[illegible] MEDITERRANEAN SEA, CONTAMINATION, OIL SPILLS, POLLUTION CONTROL,

0993 MEDITERRANEAN SEA, INVERTEBRATES, HYDROCARBONS , UPTAKE, BIOINDICATORS, *MYTILUS GALLOPROVINCIALIS,
1031 MEDITERRANEAN SEA, ENVIRONMENTAL DETERIORATION, POLLUTION PREVENTION,
1046 MEDITERRANEAN SEA, FATE, DISPERSIONS, BIODEGRADATION, BEAUFORT SEA, OIL SPILLS,
1137 MEDITERRANEAN SEA, ISRAEL, COASTS, RESOURCE MANAGEMENT, POLLUTION PREVENTION,
0743 METABOLISM, MARINE ORGANISMS, HYDROCARBONS , GREENLAND, SAMPLING, SEDIMENTS,
0943 METABOLISM, MARINE ORGANISMS, INVERTEBRATES, CONTAMINANTS, VERTEBRATES , *BIOTRANSFORMATIONS,
0971 METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FATE, DISTRIBUTION, CARCINOGENS, PAH, *PROCEEDINGS, *NEOPLASIA,
0989 METABOLISM, FISH, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, PAH, *ONCORHYNCHUS KISUTCH,
1000 METABOLISM, FUEL OIL, FOOD WEB, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *ENZYME ACTIVITY,
1040 METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, UPTAKE, *PROCEEDINGS,
1082 METABOLISM, HYDROCARBONS , CRUSTACEANS, BIODEGRADATION, *CALLINECTES SAPIDUS, POLYCHAETES, *NEREIS SP., *ARYL HYDROCARBON HYDROXYLASE,
1084 METABOLISM, MARINE ORGANISMS, BIODEGRADATION, AROMATIC HYDROCARBONS, OXIDATION, *ENZYME SYSTEMS,
1092 METABOLISM, LUBRICATING OIL, HYDROCARBONS , FUEL OIL, BIODEGRADATION, *PROCEEDINGS,
1110 METABOLISM, HEALTH HAZARDS, DISTRIBUTION, CONTAMINANTS, CARCINOGENS, PAH, SOURCES,
R092 METABOLISM, HYDROCARBONS , FISH, SUBLETHAL EFFECTS, *TEMPERATURE,
R093 METABOLISM, HYDROCARBONS , FISH, SUBLETHAL EFFECTS, *TEMPERATURE,
R105 METABOLISM, HYDROCARBONS , FISH, CHRONIC EFFECTS,
1071 METULA SPILL, BIODEGRADATION, BACTERIA, MICROORGANISMS, WEATHERING, STRAIT OF MAGELLAN,
1053 MEXICO , MARINE ORGANISMS, DISTRIBUTION, BIOGENIC HYDROCARBONS, BASELINE STUDIES, SEDIMENTS, *N-PARAFFINS,
0960 MICROORGANISMS, MARSHES, ESTUARIES, BIOLOGICAL EFFECTS, BIODEGRADATION, BACTERIA,
0980 MICROORGANISMS, DISPERSANTS, BACTERIA, PETROLEUM PRODUCTS, *DIPROKSAMIN 157, *COREXIT 7664,
0992 MICROORGANISMS, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC, SOIL,
1018 MICROORGANISMS, DISTRIBUTION, CHEDABUCTO BAY, BIODEGRADATION, BACTERIA, RECOVERY, SEDIMENTS,
1039 MICROORGANISMS, MARSHES, MARINE ORGANISMS, ESTUARIES, BIODEGRADATION, SUBLETHAL EFFECTS, *PROCEEDINGS,
1063 MICROORGANISMS, MARINE MAMMALS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, ALASKA,
1069 MICROORGANISMS, INVERTEBRATES, CRUDE OIL, BIODEGRADATION, BENTHOS, ARCTIC, MORTALITY, *RECOLONIZATION,
1070 MICROORGANISMS, BIODEGRADATION, PETROLEUM PRODUCTS, PATENT, *NUTRIENTS,
1071 MICROORGANISMS, METULA SPILL, BIODEGRADATION, BACTERIA, WEATHERING, STRAIT OF MAGELLAN,
1072 MICROORGANISMS, FUEL OIL, BIOMASS, BIODEGRADATION, PH CONTROL, *DEVIATIONS, *ALKALI CONSUMPTION,
1073 MICROORGANISMS, BIODEGRADATION, *CARBON CYCLE,
1074 MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, YEASTS,
1076 MICROORGANISMS, HYDROCARBONS , BIODEGRADATION, BACTERIA, ARCTIC OCEAN,
1079 MICROORGANISMS, CRUDE OIL, BIODEGRADATION, ARCTIC,
1080 MICROORGANISMS, HYDROCARBONS , DISPERSANTS, CRUDE OIL, BIODEGRADATION, TAR,
1083 MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, YEASTS, *REVIEW,
1088 MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, YEASTS, SOIL,
1089 MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, SOIL,
1091 MICROORGANISMS, BIODEGRADATION, *TUNDRA, NATURAL SEEPAGE, ALASKA,
1093 MICROORGANISMS, FRESHWATER, ECOSYSTEMS, BIODEGRADATION, OIL SLICKS, *CONTINUOUS CULTURE,
1094 MICROORGANISMS, CRANKCASE OIL, CHESAPEAKE BAY, CARCINOGENS, BIODEGRADATION, SEAWATER, SEDIMENTS,
1113 MICROORGANISMS, INTERTIDAL ZONE, BIODEGRADATION, AROMATIC HYDROCARBONS, SAMPLING, YUGOSLAVIA,
R099 MICROORGANISMS, BACTERIA, CRUDE OIL, CONTAMINANTS, SEAWATER, SUBLETHAL EFFECTS, *CHEMOTAXIS,
R129 MICROORGANISMS, ICE, COASTS, BIOLOGICAL EFFECTS, BIODEGRADATION, ALASKA,
R130 MICROORGANISMS, FOOD WEB, ESTUARIES, CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION, UPTAKE, NEW JERSEY,
R131 MICROORGANISMS, FATE, CRUDE OIL, BIODEGRADATION,
R132 MICROORGANISMS, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, ANALYTICAL TECHNIQUES,
R134 MICROORGANISMS, ISLAND, CRUDE OIL, BIODEGRADATION, SOIL, SUBARCTIC REGIONS,
0736 MODELS, DRIFT, DELAWARE BAY, REMOTE SENSING, SPREADING, *DENSITY FRONTS, *SATELLITES, *LANDSAT,
0831 MODELS, DISPOSAL , ATLANTIC COAST, OFFSHORE DRILLING, OCS, RESOURCE MANAGEMENT, POLLUTION PREVENTION, *[illegible],
1062 MODELS, HYDROCARBONS , BASELINE STUDIES, SAMPLING, PUGET SOUND,
1097 MODELS, [illegible] , EVAPORATION, CRUDE OIL, PETROLEUM PRODUCTS, *EQUATIONS,
1120 MODELS, FATE, DISPERSIONS, BENTHOS, MOVEMENT,
1147 MODELS, FOSSIL FUELS, FATE, ESTUARIES, CONTAMINANTS, SEDIMENTS,
1156 MODELS, HYDROCARBONS , FATE, SEA SURFACE,

1120 MODELS, FATE, TAR, SEAWATER, *PETROLEUM PARTICLES,
1121 MODELS, OXIDATION, PETROLEUM PRODUCTS, SURFACTANTS, SEAWATER, *PHENOLS, *O2 REGIMES,
1122 MODELS, EKOFISK BLOWOUT, BEHAVIOR, OIL SPILLS, SPREADING, *OILSIM,
1123 MODELS, LABRADOR SEA, DRIFT, OIL SLICKS, OFFSHORE DRILLING,
1124 MODELS, ESTUARIES, DISPERSIONS, *CONSERVATIVE AND NON-CONSERVATIVE POLLUTANTS,
R123 MODELS, MARINE ORGANISMS, HYDROCARBONS , ENVIRONMENTAL MANAGEMENT, DEVELOPMENT , BASELINE STUDIES, PUGET SOUND,
R135 MODELS, FATE, DISPERSIONS, BEHAVIOR, OIL SLICKS,
R137 MODELS, EMULSIONS, DISPERSIONS, CHEMICAL EFFECTS, OIL SLICKS, PHYSICAL EFFECTS, *WAVE ACTION,
R138 MODELS, FATE, OIL SLICKS, SPREADING, SPILL CLEANUP,
R141 MODELS, FATE, EVAPORATION, DISPERSANTS, BIODEGRADATION, OIL SPILLS, WEATHERING, *PREDICTION,
R143 MODELS, FATE, COASTS, OIL SPILLS, NOAA, *SPILL TRAJECTORY,
R145 MODELS, MARINE ORGANISMS, HYDROCARBONS , FATE, BIODEGRADATION, OIL SLICKS,
R146 MODELS, FATE, BEHAVIOR, OIL SPILLS, *PREDICTIONS,
R149 MODELS, GUIDELINES, EPA, COST ANALYSIS, API, STATISTICAL ANALYSIS, REFINERIES, WASTEWATERS,
0946 MOLLUSKS, HYDROCARBONS , CHRONIC EFFECTS, UPTAKE, RELEASE, RIVERS, *MERCENARIA MERCENARIA,
0953 MOLLUSKS, HYDROCARBONS , CRUDE OIL, BACTERIA, TOXICITY, WSF, WASTE OIL, SUBLETHAL EFFECTS, MORTALITY,
0956 MOLLUSKS, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, *GENETIC STRUCTURE, *UROSALPINX CINEREA,
0965 MOLLUSKS, GROWTH, FUEL OIL, CHRONIC EFFECTS, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, UPTAKE, *CARBON FLUX, *MYA ARENARIA,
0966 MOLLUSKS, MAINE, CHRONIC EFFECTS, OIL SPILLS, *CLAMS, MORTALITY, SEDIMENTS,
0987 MOLLUSKS, CRUDE OIL, UPTAKE, *NAPHTHALENES, SEDIMENTS, PRUDHOE BAY, *MACOMA INQUINATA,
0994 MOLLUSKS, BEHAVIOR, FUEL OIL, TOXICITY, UPTAKE, RELEASE, *RESPIRATION, *MYA ARENARIA,
0995 MOLLUSKS, HYDROCARBONS , FUEL OIL, SUBLETHAL EFFECTS, UPTAKE, RELEASE, *RESPIRATION RATES, *MYA ARENARIA,
1000 MOLLUSKS, METABOLISM, FUEL OIL, FOOD WEB, CRUDE OIL, BIOLOGICAL EFFECTS, *ENZYME ACTIVITY,
1027 MOLLUSKS, CRUDE OIL, ADSORPTION, ABSORPTION, SEDIMENTS, UPTAKE, *OYSTERS,
1165 MOLLUSKS, BIOASSAY, BIOINDICATORS, UPTAKE, *MERCURY, *FIELD TECHNIQUE,
R104 MOLLUSKS, MARINE ORGANISMS, HYDROCARBONS , CONTAMINANTS, *TUMORS,
R107 MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS, NATURAL SEEPAGE, SEDIMENTS, SAMPLING,
R108 MOLLUSKS, CRUSTACEANS, BIOLOGICAL EFFECTS, BIOINDICATORS, WASTEWATERS, REFINERIES, PACIFIC OCEAN,
0727 MONITORING, ENVIRONMENTAL DETERIORATION, REFINERIES, OIL TERMINALS, UK,
0728 MONITORING, CHEMICAL ANALYSIS, REMOTE SENSING, *FLUOROMETRY,
0729 MONITORING, CHEMICAL ANALYSIS, UPTAKE, PATENT, *FLUOROMETRY,
0730 MONITORING, EQUIPMENT, CHEMICAL ANALYSIS, *INFRARED DETECTION ,
0731 MONITORING, EQUIPMENT, DETECTION, PATENT, *FLUORESCENCE ANALYSIS,
0732 MONITORING, FUEL OIL, DETECTION, SEDIMENTS, SOIL, *ELECTRICAL RESISTIVITY,
0733 MONITORING, GOVERNMENT AGENCIES, EPA, ENVIRONMENTAL MANAGEMENT,
0734 MONITORING, INCINERATION, BALLAST , OIL-WATER SEPARATION, SHIPS, POLLUTION PREVENTION, WASTEWATERS,
0736 MONITORING, LEGISLATION, EUROPE, REMOTE SENSING, SURVEILLANCE, *SATELLITES,
0737 MONITORING, ESTUARIES, DETECTION, COASTS, REMOTE SENSING,
0740 MONITORING, FOSSIL FUELS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BOOK REVIEW, REMOTE SENSING,
0744 MONITORING, EQUIPMENT, SAMPLING, WASTEWATERS, WATER QUALITY,
0754 MONITORING, BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY, SOURCES, *BIOLOGICAL TESTS,
0777 MONITORING, MARINE ORGANISMS, HYDROCARBONS , CHROMATOGRAPHY, *UV ABSORPTION,
0804 MONITORING, FATE, EQUIPMENT, ARGO MERCHANT SPILL, SPILL CLEANUP, *ACCIDENT RESPONSE,
0813 MONITORING, MANUALS, GROUNDWATER, ENVIRONMENTAL EFFECTS, DISPOSAL , *OIL SPILL DEBRIS, *LANDFILLS,
0846 MONITORING, GRAVITY SEPARATION, OIL-WATER SEPARATION, PRODUCT INFORMATION,
0925 MONITORING, BILGES, BALLAST , PRODUCT INFORMATION, SPILL REMOVAL, POLLUTION PREVENTION,
0935 MONITORING, LEAKAGE, EQUIPMENT, PRODUCT INFORMATION, PIPELINES, OIL TANKS, *ACOUSTIC EMISSION MONITOR,
R034 MONITORING, LAKES , GC/MS, GASOLINE, CALIFORNIA, WATER QUALITY, *RECREATIONAL BOATING,
R039 MONITORING, DISPERSIONS, OIL SPILLS, OCEANS, *CURRENT SENSOR, *INCLINING SPAR BUOY,
R044 MONITORING, BALLAST , PHYTOPLANKTON, TOXICITY, ALASKA,
R046 MONITORING, HYDROCARBONS , ESTUARIES, ENVIRONMENTAL EFFECTS, BIOGENIC HYDROCARBONS, ADSORPTION, SEDIMENTATION,
R124 MONITORING, FATE, BIODEGRADATION, TOXICITY, SOIL,
0710 MORTALITY, FISH, CONTAMINATION, OIL SPILLS, *[illegible] SPILL, *HONG KONG,
0718 MORTALITY, BIRDS, OIL TERMINALS, TANKERS, OIL SPILLS, OIL SLICKS, *MILFORD HAVEN,
0720 MORTALITY, MARINE ORGANISMS, INTERTIDAL ZONE, FRANCE, ENVIRONMENTAL EFFECTS, AMOCO CADIZ SPILL,
0861 MORTALITY, BIRDS, OIL SLICKS, UK,
0961 MORTALITY, FUEL OIL, BIRDS, *[illegible], *DUCKS,
0966 MORTALITY, MARINE ORGANISMS, CRUSTACEANS, CONTAMINANTS, *LETHAL CONCENTRATION, *[illegible] [illegible],

0953 MORTALITY, MOLLUSKS HYDROCARBONS , CRUDE OIL, BACTERIA, TOXICITY, WSF, WASTE OIL, SUBLETHAL EFFECTS,
0959 MORTALITY, FUEL OIL CRUSTACEANS, CRUDE OIL, WSF, TOXICITY, *LARVAE,
0966 MORTALITY, MOLLUSKS MAINE, CHRONIC EFFECTS, OIL SPILLS, *CLAMS, SEDIMENTS,
0970 MORTALITY, DISPERSANTS, ARCTIC, PHYTOPLANKTON, PETROLEUM PRODUCTS, *COREXIT 7664, *DIPROKSAMIN 157
0985 MORTALITY, GROWTH, FISH, CRUDE OIL, BIOASSAY, ACUTE EFFECTS, PRUDHOE BAY, *ONCORHYNCHUS GORBUSCHA,
0991 MORTALITY, DISPERSANTS, CRUSTACEANS, CRUDE OIL, ARCTIC, ACUTE EFFECTS, TOXICITY, *COREXIT 9527,
0997 MORTALITY, CONTAMINATION, BIRDS, BIOLOGICAL EFFECTS, *EGGS, *HATCHABILITY,
1004 MORTALITY, CONTAMINATION, BIRDS, BALTIC SEA, RECOVERY,
1069 MORTALITY, MICROORGANISMS, INVERTEBRATES, CRUDE OIL, BIODEGRADATION, BENTHOS, ARCTIC, *RECOLONIZATION,
1099 MOVEMENT, LAKES , EVAPORATION, CRUDE OIL, OIL SLICKS, SPREADING,
1100 MOVEMENT, MODELS, FATE, DISPERSIONS, BEHAVIOR,
0772 NARRAGANSETT BAY, HYDROCARBONS , CHRONIC EFFECTS, BIOGENIC HYDROCARBONS, SEDIMENTS, SOURCES, *RHODE SLAND SOUND,
0877 NARRAGANSETT BAY, HYDROCARBONS , FATE, ESTUARIES, COASTS, WASTEWATERS, SEDIMENTATION, RIVERS, *PROVIDENCE RIVER,
0735 NATURAL SEEPAGE, REMOTE SENSING, OIL SLICKS, *LUMINESCENCE, *FRAUNHOFER LINE DISCRIMINATOR,
1091 NATURAL SEEPAGE, MICROORGANISMS, BIODEGRADATION, *TUNDRA, ALASKA,
R107 NATURAL SEEPAGE, MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS, SEDIMENTS, SAMPLING,
R130 NEW JERSEY, MICROORGANISMS, FOOD WEB, ESTUARIES, CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION, PTAKE,
1132 NOAA, LEGISLATION, RESEARCH MANAGEMENT,
R109 NOAA, MARINE ORGANIMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNQUES, TOXICITY, SUBARCTIC REGIONS,
R143 NOAA, MODELS, FATE,COASTS, OIL SPILLS, *SPILL TRAJECTORY,
1042 NORTH CAROLINA, ENVRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL INDUSTRY, SOCIAL EFFECTS, *COASTAL PLAINS,
0715 NORTH SEA, BIRDS, OIL TERMINALS, STATISTICS, SCOTLAND,
1114 NORTH SEA, FATE, BEAVIOR, ARGO MERCHANT SPILL, SPILL CLEANUP,
1138 NORTH SEA, LEGISLATON, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORWAY, UK,
0742 NORWAY, MARINE ORGAISMS, CRUDE OIL, CHEMICAL ANALYSIS, BENTHOS, AROMATIC HYDROCARBONS, SAPLING,
0778 NORWAY, DETECTION, OURCE IDENTIFICATION, OIL SPILLS, PLATFORMS, OIL TRANSFER, *LASER SYSTEM,
1138 NORWAY, NORTH SEA, EGISLATION, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, UK,
0822 OCEANS, IMCO, RESOUCE MANAGEMENT, TANKERS, REGULATIONS, TORREY CANYON SPILL,
1020 OCEANS, ENVIRONMENTL DETERIORATION, CONSERVATION, RESOURCE MANAGEMENT, RECOVERY,
1030 OCEANS, INDUSTRIES,ENVIRONMENTAL EFFECTS, OIL SPILLS,
1033 OCEANS, CONTAMINATIN, BIOLOGICAL EFFECTS, SOURCES, PHYTOPLANKTON, *RATE OF INPUT,
1034 OCEANS, LAKES , INDSTRIES, BOOK REVIEW, WATER QUALITY, SOURCES,
1035 OCEANS, DRILLING , IL SPILLS, TANKERS,
1152 OCEANS, ESTUARIES, IBLIOGRAPHIES,
1159 OCEANS, POLLUTION ONTROL, WASTEWATER TREATMENT, SOLID WASTES, SAFETY, *REVIEW,
R059 OCEANS, MONITORING,DISPERSIONS, OIL SPILLS, *CURRENT SENSOR, *INCLINING SPAR BUOY,
R068 OCEANS, MARINE ORGAISMS, HYDROCARBONS , CHEMICAL ANALYSIS, *TRACE GASES,
R133 OCEANS, ESTUARIES, RUDE OIL, BIODEGRADATION, BACTERIA, SEA SURFACE, SEDIMENTS, *WATER COLUMN,
R160 OCEANS, FATE, DISTRBUTION, BIOGENIC HYDROCARBONS, PETROCHEMICALS, SEDIMENTATION,
0931 OCS, MODELS, DISPOSL , ATLANTIC COAST, OFFSHORE DRILLING, RESOURCE MANAGEMENT, POLLUTION PREVENION, *WORKSHOP,
1037 OCS, LEGISLATION, EVIRONMENTAL EFFECTS, COASTS, OIL SPILLS,
1045 OCS, LAW ENFORCEMEN, INTERNATIONAL AGREEMENTS, OFFSHORE DEVELOPMENT, OIL TRANSPORT, POLLUTION CONTRL,
1056 OCS, ENVIRONMENTAL FFECTS, BLM, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *EDITORIAL,
1062 OCS, GULF OF ALASKA ENVIRONMENTAL EFFECTS, CRUDE OIL, BLM, BEAUFORT SEA, OFFSHORE DEVELOPMENT,
1063 OCS, MICROORGANISMS MARINE MAMMALS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, OFFSHORE DEVELOMENT, ALASKA,
1064 OCS, INTERTIDAL ZON, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, PLNKTON , ALASKA,
1065 OCS, ENVIRONMENTAL FFECTS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, SAFETY, STATISTICS, ALSKA, *HAZARDS,
1066 OCS, ENVIRONMENTAL FFECTS, DEVELOPMENT , BLM, OIL-GAS LEASING, *ENVIRONMENTAL STUDIES PROGRAM,
1126 OCS, LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, REGULATIONS, STATE GOVERNMENTS, [illegible] , TANKERS,
1131 OCS, LIABILITY, LEGISLATION, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, SANTA BARBARA CHANNEL,
R121 OCS, MARINE ORGANISMS, INTERTIDAL ZONE, GUIDELINES, ENVIRONMENTAL PROTECTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , [illegible], ALASKA,

1044 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING, OIL SPILLS,
1045 OFFSHORE DEVELOPMENT, OCS, LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, OIL TRANSPORT, POLLUTION CONTROL,
1047 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, UK, PORTS , OIL TERMINALS, TANKERS, *OCEAN MANAGEMENT, *PROCEEDINGS,
1051 OFFSHORE DEVELOPMENT, GEORGES BANK, FISHERIES, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION, RESOURCE MANAGEMENT,
1054 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BLM, BASELINE STUDIES, *EDITORIAL,
1062 OFFSHORE DEVELOPMENT, OCS, GULF OF ALASKA, ENVIRONMENTAL EFFECTS, CRUDE OIL, BLM, BEAUFORT SEA,
1063 OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, MARINE MAMMALS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,
1064 OFFSHORE DEVELOPMENT, OCS, INTERTIDAL ZONE, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, PLANKTON , ALASKA,
1065 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, SAFETY, STATISTICS, ALASKA, *HAZARDS,
1138 OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, LEGISLATION, POLLUTION CONTROL, UK,
R079 OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING, PIPELINES, POLLUTION PREVENTION,
0873 OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, DISPOSAL , BEAUFORT SEA, WASTEWATERS, *DRILLING MUD,
0929 OFFSHORE DRILLING, EQUIPMENT, POLLUTION PREVENTION, PLATFORMS, PATENT,
0931 OFFSHORE DRILLING, OCS, MODELS, DISPOSAL , ATLANTIC COAST, RESOURCE MANAGEMENT, POLLUTION PREVENTION, *WORKSHOP,
1044 OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SPILLS,
1111 OFFSHORE DRILLING, MARINE ORGANISMS, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, SHORELINES,
1123 OFFSHORE DRILLING, MODELS, LABRADOR SEA, DRIFT, OIL SLICKS,
1051 OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, GEORGES BANK, FISHERIES, ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT,
1049 OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT, OIL TRANSPORT,
1157 OFFSHORE PRODUCTION, EQUIPMENT, SAFETY, POLLUTION PREVENTION, *ACCREDITATION, *TESTING LABORATORIES,
1158 OFFSHORE PRODUCTION, EQUIPMENT, SAFETY, POLLUTION PREVENTION, *QUALITY ASSURANCE, *CERTIFICATION,
0821 OIL DISCHARGES, IMCO, CRUDE OIL WASHING, TANKERS, POLLUTION PREVENTION, *LOAD-ON-TOP,
1129 OIL DISCHARGES, LIABILITY, LEGISLATION, US, OIL SPILLS, *WATER POLLUTION CONTROL ACT,
R085 OIL DISCHARGES, CHEMICAL EFFECTS, SOURCES, POLLUTION CONTROL, *MILITARY INSTALLATIONS,
1048 OIL FIELDS, HEALTH HAZARDS, GROUNDWATER, OIL INDUSTRY, SOURCES, POLLUTION CONTROL,
R118 OIL FIELDS, MARSHES, HYDROCARBONS , GROUNDWATER, CONTAMINATION, BIODEGRADATION, SEDIMENTS,
R119 OIL FIELDS, GULF OF MEXICO, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, CONTAMINANTS,
1066 OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BLM, *ENVIRONMENTAL STUDIES PROGRAM,
0717 OIL INDUSTRY, EUROPE, PIPELINES, PETROLEUM PRODUCTS, STATISTICS, OIL SPILLS,
0843 OIL INDUSTRY, GUIDELINES, CANADA, WASTEWATERS, REFINERIES, POLLUTION PREVENTION, REGULATIONS,
0871 OIL INDUSTRY, ACTIVATED SLUDGE, REFINERIES, *ACTIVATED CARBON, *EFFLUENT QUALITY,
0914 OIL INDUSTRY, ENVIRONMENTAL MANAGEMENT, ECONOMICS, DISPOSAL , WASTE OIL, REFINING, RECYCLING,
0930 OIL INDUSTRY, POLLUTION PREVENTION, SAFETY,
0938 OIL INDUSTRY, POLLUTION CONTROL, REFINERIES, SOURCES, REGULATIONS,
1042 OIL INDUSTRY, NORTH CAROLINA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, SOCIAL EFFECTS, *COASTAL PLAINS,
1048 OIL INDUSTRY, OIL FIELDS, HEALTH HAZARDS, GROUNDWATER, SOURCES, POLLUTION CONTROL,
1140 OIL INDUSTRY, EUROPE, REGULATIONS, POLLUTION PREVENTION,
1163 OIL INDUSTRY, GOVERNMENT AGENCIES, FISH, ENVIRONMENTAL PROTECTION, WILDLIFE, OIL SHALE, RESOURCE MANAGEMENT,
R060 OIL INDUSTRY, GROUNDWATER, CONTAMINATION, SAMPLING, SOLID WASTES, *LEACHING TEST,
R120 OIL INDUSTRY, LOUISIANA, DEVELOPMENT , COASTS,
R147 OIL INDUSTRY, EPA, API, WATER QUALITY, POLLUTION CONTROL, STATISTICAL ANALYSIS,
0758 OIL SHALE, CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, *COAL OIL,
1057 OIL SHALE, EIS, DEVELOPMENT , BASELINE STUDIES, POLLUTION CONTROL, RESOURCE MANAGEMENT,
1163 OIL SHALE, OIL INDUSTRY, GOVERNMENT AGENCIES, FISH, ENVIRONMENTAL PROTECTION, WILDLIFE, RESOURCE MANAGEMENT,
R122 OIL SHALE, FISH, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, WILDLIFE, *POPULATION REDUCTIONS,
0719 OIL SLICKS, MORTALITY, BIRDS, OIL TERMINALS, TANKERS, OIL SPILLS, *MILFORD HAVEN,
0735 OIL SLICKS, NATURAL SEEPAGE, REMOTE SENSING, *LUMINESCENCE, *FRAUNHOFER LINE DISCRIMINATOR,
0937 OIL SLICKS, LUBRICATING OIL, DISPOSAL , POLLUTION PREVENTION, POLLUTION CONTROL, REUSE,
0946 OIL SLICKS, MORTALITY, BIRDS, UK,
1009 OIL SLICKS, MAMMALS, BIRDS, RESTORATION,
1092 OIL SLICKS, MICROORGANISMS, FRESHWATER, ECOSYSTEMS, BIODEGRADATION, *CONTINUOUS CULTURE,

1096 OIL SLICKS, ICE, FRESHWATER, BEHAVIOR, SOLUTION, SPILL CLEANUP,
1099 OIL SLICKS, MOVEMENT, LAKES , EVAPORATION, CRUDE OIL, SPREADING,
1123 OIL SLICKS, OFFSHORE DRILLING, MODELS, LABRADOR SEA, DRIFT,
1170 OIL SLICKS, BEHAVIOR, SPILL CONTAINMENT, *FLUME,
R086 OIL SLICKS, POLLUTION CONTROL, USN, SHIPS, SEA SURFACE, *INTERFACE CHEMISTRY,
R135 OIL SLICKS, MODELS, FATE, DISPERSIONS, BEHAVIOR,
R137 OIL SLICKS, MODELS, EMULSIONS, DISPERSIONS, CHEMICAL EFFECTS, PHYSICAL EFFECTS, *WAVE ACTION,
R138 OIL SLICKS, MODELS, FATE, SPREADING, SPILL CLEANUP,
R145 OIL SLICKS, MODELS, MARINE ORGANISMS, HYDROCARBONS , FATE, BIODEGRADATION,
0710 OIL SPILLS, MORTALITY, FISH, COMPENSATION, *ADRIAN MAERSK SPILL, *HONG KONG,
0712 OIL SPILLS, MEDITERRANEAN SEA, CONTAMINATION, POLLUTION CONTROL,
0717 OIL SPILLS, OIL INDUSTRY, EUROPE, PIPELINES, PETROLEUM PRODUCTS, STATISTICS,
0718 OIL SPILLS, CANADA, STATISTICS, PETROLEUM PRODUCTS, *NATES DATABASE,
0719 OIL SPILLS, OIL SLICKS, MORTALITY, BIRDS, OIL TERMINALS, TANKERS, *MILFORD HAVEN,
0721 OIL SPILLS, STATISTICS, USCG, *NEW ENGLAND , *REVIEW,
0724 OIL SPILLS, TANKERS, STATISTICS,
0725 OIL SPILLS, TANKERS, STATISITCS,
0778 OIL SPILLS, NORWAY, DETECTION, SOURCE IDENTIFICATION, PLATFORMS, OIL TRANSFER, *LASER SYSTEM,
0780 OIL SPILLS, SOURCE IDENTIFICATION, SEAWATER, SOURCES, *ORGANIC MATTER,
0802 OIL SPILLS, LEGISLATION, BOOMS, SPILL CLEANUP, SKIMMERS, POLLUTION PREVENTION,
0920 OIL SPILLS, MANUALS, API, PERSONNEL TRAINING, STATISTICS,
0922 OIL SPILLS, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, TANKERS, SAFETY,
0926 OIL SPILLS, CONTINGENCY PLANNING, POLLUTION PREVENTION, *HONG KONG,
0928 OIL SPILLS, ENVIRONMENTAL EFFECTS, DELAWARE BAY, CONTINGENCY PLANNING, OIL TRANSFER, POLLUTION CONTROL,
0952 OIL SPILLS, HYDROCARBONS , ARCTIC, AMPHIPODS, TOXICITY,
0966 OIL SPILLS, MORTALITY, MOLLUSKS, MAINE, CHRONIC EFFECTS, *CLAMS, SEDIMENTS,
1007 OIL SPILLS, CONSERVATION, BIRDS, RESTORATION, TORREY CANYON SPILL,
1011 OIL SPILLS, SPILL REMOVAL, SOIL, RESTORATION,
1030 OIL SPILLS, OCEANS, INDUSTRIES, ENVIRONMENTAL EFFECTS,
1035 OIL SPILLS, OCEANS, DRILLING , TANKERS,
1037 OIL SPILLS, OCS, LEGISLATION, ENVIRONMENTAL EFFECTS, COASTS,
1044 OIL SPILLS, OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
1046 OIL SPILLS, MEDITERRANEAN SEA, FATE, DISPERSIONS, BIODEGRADATION, BEAUFORT SEA,
1059 OIL SPILLS, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, BAHAMAS, TANKERS,
1115 OIL SPILLS, EVAPORATION, BIODEGRADATION, SEAWATER, *KINETICS,
1122 OIL SPILLS, MODELS, EKOFISK BLOWOUT, BEHAVIOR, SPREADING, *OILSIM,
1129 OIL SPILLS, OIL DISCHARGES, LIABILITY, LEGISLATION, US, *WATER POLLUTION CONTROL ACT,
1139 OIL SPILLS, GUIDELINES, COASTS, ONSHORE IMPACTS, *SHORELINE TYPE CLASSIFICATION, *CASE STUDIES,
1141 OIL SPILLS, ENVIRONMENTAL PROTECTION, AMOCO CADIZ SPILL, SAFETY, TANKERS, *NEGOTIATIONS,
1154 OIL SPILLS, ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, PORTS , *SUPERTANKERS,
R059 OIL SPILLS, OCEANS, MONITORING, DISPERSIONS, *CURRENT SENSOR, *INCLINING SPAR BUOY,
R061 OIL SPILLS, BUZZARDS BAY, BIOLOGICAL EFFECTS, BENTHOS, ANALYTICAL TECHNIQUES, SAMPLING, *X-RAY RADIOGRAPHY,
R087 OIL SPILLS, FATE, BEHAVIOR, SOURCE IDENTIFICATION, SPILL CLEANUP, SURVEILLANCE, POLLUTION PREVENTION,
R141 OIL SPILLS, MODELS, FATE, EVAPORATION, DISPERSANTS, BIODEGRADATION, WEATHERING, *PREDICTION,
R143 OIL SPILLS, NOAA, MODELS, FATE, COASTS, *SPILL TRAJECTORY,
R144 OIL SPILLS, ENVIRONMENTAL EFFECTS, COASTS, ALASKA, *VULNERABILITY, *KODIAK ISLAND,
R146 OIL SPILLS, MODELS, FATE, BEHAVIOR, *PREDICTIONS,
0899 OIL TANKS, OIL-WATER SEPARATION, WASTE OIL, TANKERS, PATENT, *WASTE CLAY,
0935 OIL TANKS, MONITORING, LEAKAGE, EQUIPMENT, PRODUCT INFORMATION, PIPELINES, *ACOUSTIC EMISSION MONITOR,
R084 OIL TANKS, DESIGN-ENGINEERING, STORAGE, OIL-WATER SEPARATION, RECLAMATION, USN, *TANK CLEANING,
0715 OIL TERMINALS, NORTH SEA, BIRDS, STATISTICS, SCOTLAND,
0719 OIL TERMINALS, OIL SPILLS, OIL SLICKS, MORTALITY, BIRDS, TANKERS, *MILFORD HAVEN,
0727 OIL TERMINALS, MONITORING, ENVIRONMENTAL DETERIORATION, REFINERIES, UK,
0860 OIL TERMINALS, FLOTATION, WASTEWATER TREATMENT, *COAGULATION, USN, SKIMMERS,
0863 OIL TERMINALS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, TANKERS, USN, VIRGINIA,
1043 OIL TERMINALS, ENVIRONMENTAL PROTECTION, OIL TRANSPORT, ALASKA,
1047 OIL TERMINALS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, UK, PORTS , TANKERS, *OCEAN MANAGEMENT, *PROCEEDINGS,
1167 OIL TERMINALS, ENVIRONMENTAL EFFECTS, CANADA, PIPELINES,
0778 OIL TRANSFER, OIL SPILLS, NORWAY, DETECTION, SOURCE IDENTIFICATION, PLATFORMS, *LASER SYSTEM,
0928 OIL TRANSFER, OIL SPILLS, ENVIRONMENTAL EFFECTS, DELAWARE BAY, CONTINGENCY PLANNING, POLLUTION CONTROL,

0921 OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING, PERSONNEL TRAINING, PLATFORMS, TANKERS, SHIPS, SAFETY,
1043 OIL TRANSPORT, OIL TERMINALS, ENVIRONMENTAL PROTECTION, ALASKA,
1045 OIL TRANSPORT, OFFSHORE DEVELOPMENT, OCS, LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, POLLUTION CONTROL,
1049 OIL TRANSPORT, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT,
R078 OIL TRANSPORT, ENVIRONMENTAL PROTECTION, PRODUCTION , PUGET SOUND,
R114 OIL TRANSPORT, HABITATS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIRDS, PIPELINES, ALASKA, *WETLAND RESOURCES,
0734 OIL-WATER SEPARATION, MONITORING, INCINERATION, BALLAST , SHIPS, POLLUTION PREVENTION, WASTEWATERS,
0826 OIL-WATER SEPARATION, INDUSTRIES, ADSORPTION, WASTEWATERS, *AGENT NT75,
0839 OIL-WATER SEPARATION, ABSORPTION, SLUDGE , PATENT,
0840 OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION , COALESCENCE, BALLAST , PATENT, *DEWAXING UNIT,
0841 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ULTRAFILTRATION, *MEMBRANES,
0857 OIL-WATER SEPARATION, COALESCENCE, WASTEWATER TREATMENT, PATENT,
0859 OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION , SLUDGE , PATENT, WASTEWATER TREATMENT,
0861 OIL-WATER SEPARATION, BILGES, WASTEWATER TREATMENT, PATENT, *DECANTATION TANKS,
0866 OIL-WATER SEPARATION, INDUSTRIES, WASTEWATER TREATMENT, ULTRAFILTRATION, *POROUS GLASS MEMBRANE,
0867 OIL-WATER SEPARATION, INCINERATION, FLOTATION, FILTRATION , WASTEWATER TREATMENT, SHIPS,
0874 OIL-WATER SEPARATION, LUBRICATING OIL, *OIL REMOVAL, WASTE OIL TREATMENT, PATENT,
0876 OIL-WATER SEPARATION, HYDROCARBONS , WASTEWATER TREATMENT, SAMPLING,
0880 OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, PATENT,
0881 OIL-WATER SEPARATION, FRESHWATER, FILTRATION , CONTAMINANTS, PATENT,
0882 OIL-WATER SEPARATION, FILTRATION , DISPERSANTS, PATENT,
0883 OIL-WATER SEPARATION, COALESCENCE, WASTEWATER TREATMENT, REFINERIES, *FIBROUS BEDS,
0884 OIL-WATER SEPARATION, ABSORPTION, SORBENTS, PATENT,
0885 OIL-WATER SEPARATION, LUBRICATING OIL, COST ANALYSIS, BIOLOGICAL EFFECTS,
0886 OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, SPILL REMOVAL, PRODUCT INFORMATION, *ENQUIP INC,
0887 OIL-WATER SEPARATION, EQUIPMENT, *CYCLONET,
0888 OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, COALESCENCE, PRODUCT INFORMATION,
0889 OIL-WATER SEPARATION, EPA, COALESCENCE, REUSE, REGULATIONS, PRODUCT INFORMATION,
0890 OIL-WATER SEPARATION, FILTRATION , EMULSIONS, PETROLEUM PRODUCTS,
0891 OIL-WATER SEPARATION, EQUIPMENT, SOLID WASTES, PATENT, *SLURRIES,
0892 OIL-WATER SEPARATION, HYDROCARBONS , AROMATIC HYDROCARBONS, PATENT, *MEMBRANES,
0893 OIL-WATER SEPARATION, FLOTATION, FLOCCULATION, FILTRATION , WASTEWATER TREATMENT, PATENT,
0894 OIL-WATER SEPARATION, EQUIPMENT, EMULSIONS, DESIGN-ENGINEERING, PATENT, *ELECTRIC TREATMENT,
0895 OIL-WATER SEPARATION, PATENT, SORBENTS, *PLASTICS,
0896 OIL-WATER SEPARATION, MONITORING, GRAVITY SEPARATION, PRODUCT INFORMATION,
0897 OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, BILGES, ADSORPTION, WASTEWATERS, SEAWATER, PATENT,
0898 OIL-WATER SEPARATION, EQUIPMENT, EMULSIONS, PATENT,
0899 OIL-WATER SEPARATION, OIL TANKS, WASTE OIL, TANKERS, PATENT, *WASTE CLAY,
0900 OIL-WATER SEPARATION, SPILL REMOVAL, PRODUCT INFORMATION, *OIL RECOVERY SYSTEMS INC,
0901 OIL-WATER SEPARATION, FILTRATION , EMULSIONS, PH CONTROL,
0902 OIL-WATER SEPARATION, FILTRATION , DESIGN-ENGINEERING, WASTEWATERS, PATENT,
0903 OIL-WATER SEPARATION, HYDROCARBONS , EQUIPMENT, PATENT,
0904 OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT, SLUDGE ,
0905 OIL-WATER SEPARATION, ADSORPTION, SORBENTS, PATENT,
0906 OIL-WATER SEPARATION, LUBRICATING OIL, ADSORPTION, PATENT,
0907 OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, PATENT, *SORBENT GAUZE,
0908 OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, PATENT,
0909 OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, ADSORPTION, WASTEWATERS, PATENT,
R084 OIL-WATER SEPARATION, OIL TANKS, DESIGN-ENGINEERING, STORAGE, RECLAMATION, USN, *TANK CLEANING,
1139 ONSHORE IMPACTS, OIL SPILLS, GUIDELINES, COASTS, *SHORELINE TYPE CLASSIFICATION, *CASE STUDIES,
0827 OXIDATION, BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, REFINERIES, *AERATION,
0855 OXIDATION, CONSERVATION, WASTEWATER TREATMENT, REFINERIES, REUSE, *BIOOXIDATION,
1064 OXIDATION, METABOLISM, MARINE ORGANISMS, BIODEGRADATION, AROMATIC HYDROCARBONS, *ENZYME SYSTEMS,
1121 OXIDATION, MODELS, PETROLEUM PRODUCTS, SURFACTANTS, SEAWATER, *PHENOLS, *O2 REGIMES,
R067 OXIDATION, HYDROCARBONS , DELAWARE, CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, SEDIMENTS, UPTAKE, *CHARACTERIZATION,
1024 PACIFIC OCEAN, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, SOURCES, SPILL CLEANUP,
R108 PACIFIC OCEAN, MOLLUSKS, CRUSTACEANS, BIOLOGICAL EFFECTS, BIOINDICATORS, WASTEWATERS, REFINERIES,
0749 PAH, DISTILLATION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SPECTROMETRY,

0750 PAH, GULF OF MEXICO, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *CRASSOSTREA VIRGINICA,
0757 PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WATER QUALITY,
0771 PAH, CHROMATOGRAPHY, *SURVEY, *HPLC,
0878 PAH, HYDROCARBONS , FLOCCULATION, CONTAMINANTS, WASTEWATER TREATMENT,
0971 PAH, METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FATE, DISTRIBUTION, CARCINOGENS, *PROCEEDINGS, *NEOPLASIA,
0982 PAH, CRANKCASE OIL, BIOLOGICAL EFFECTS, *MUTAGENIC ACTIVITY,
0986 PAH, INVERTEBRATES, HYDROCARBONS , CRUDE OIL, UPTAKE, SEDIMENTS, PRUDHOE BAY,
0989 PAH, METABOLISM, FISH, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, *ONCORHYNCHUS KISUTCH,
1055 PAH, LAKES , CANADA, BIOGENIC HYDROCARBONS, SAMPLING,
1104 PAH, MARINE ORGANISMS, HYDROCARBONS , FOOD WEB, BIODEGRADATION, SOURCES, UPTAKE, RELEASE,
1110 PAH, METABOLISM, HEALTH HAZARDS, DISTRIBUTION, CONTAMINANTS, CARCINOGENS, SOURCES,
1117 PAH, ESTUARIES, CRUDE OIL, SEDIMENTS, SOURCES, UK,
R081 PAH, HEALTH HAZARDS, CONTAMINANTS, ANIMALS, WASTEWATERS, TOXICITY,
0729 PATENT, MONITORING, CHEMICAL ANALYSIS, UPTAKE, *FLUOROMETRY,
0731 PATENT, MONITORING, EQUIPMENT, DETECTION, *FLUORESCENCE ANALYSIS,
0755 PATENT, EQUIPMENT, SAMPLING, PETROLEUM PRODUCTS,
0786 PATENT, DISPERSANTS, SPILL CLEANUP,
0790 PATENT, ADSORPTION, SPILL REMOVAL, *PERLITE,
0793 PATENT, EMULSIONS, ADSORPTION, SPILL CLEANUP, *EXPANDED PYROPHYLLITE,
0794 PATENT, BEACH CLEANUP, ABSORPTION, SPILL REMOVAL, SEA SURFACE,
0795 PATENT, ADSORPTION, SPILL REMOVAL, SORBENTS, SURFACTANTS,
0796 PATENT, ADSORPTION, SPILL CLEANUP, *SORBENT KAPOK FIBERS,
0797 PATENT, SPILL REMOVAL, SORBENTS, *FOAM MATS,
0798 PATENT, BEACH CLEANUP, SPILL REMOVAL, SEDIMENTS,
0799 PATENT, ABSORPTION, SPILL REMOVAL, SOLVENTS, *POLYMERS,
0804 PATENT, ADSORPTION, SPILL REMOVAL, *SHAPED PITCH,
0806 PATENT, EQUIPMENT, BOOMS, SPILL CONTAINMENT, SPILL REMOVAL, SHIPS,
0808 PATENT, DESIGN-ENGINEERING, SPILL REMOVAL, SORBENTS,
0809 PATENT, ADSORPTION, SORBENTS, SPILL CLEANUP, *ATTAPULGITE,
0810 PATENT, ABSORPTION, SPILL REMOVAL,
0812 PATENT, EMULSIFICATION, DECOMPOSITION, CRUDE OIL, SPILL REMOVAL, YEAST, *RICE BRAN,
0814 PATENT, ABSORBENTS, SPILL REMOVAL, *POLYURETHANE RESIN FOAM,
0815 PATENT, DISTILLATION, ABSORPTION, SPILL REMOVAL, *CEMENT,
0816 PATENT, DISPERSANTS, SPILL CLEANUP, PETROLEUM PRODUCTS,
0818 PATENT, SPILL CLEANUP, *AGENT,
0819 PATENT, ABSORPTION, SPILL REMOVAL, *FIBER MATERIAL,
0833 PATENT, FLOCCULATION, EMULSIONS, ABSORPTION, WASTEWATER TREATMENT, *COAGULATION,
0835 PATENT, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, *DETERGENT-OIL MIXTURES,
0836 PATENT, EMULSIONS, ADSORPTION, WASTEWATER TREATMENT,
0839 PATENT, OIL-WATER SEPARATION, ABSORPTION, SLUDGE ,
0840 PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION , COALESCENCE, BALLAST , *DEWAXING UNIT,
0846 PATENT, WASTEWATER TREATMENT, SURFACTANTS, *ELECTROLYSIS,
0849 PATENT, FLOTATION, WASTEWATER TREATMENT, SHIPS, *ELECTROLYSIS,
0850 PATENT, INCINERATION, ABSORPTION, *ATOMIZATION, WASTEWATER, WASTE OIL,
0857 PATENT, OIL-WATER SEPARATION, COALESCENCE, WASTEWATER TREATMENT,
0858 PATENT, WASTEWATER TREATMENT, *ELECTROLYSIS,
0859 PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION , SLUDGE , WASTEWATER TREATMENT,
0861 PATENT, OIL-WATER SEPARATION, BILGES, WASTEWATER TREATMENT, *DECANTATION TANKS,
0864 PATENT, FILTRATION , WASTEWATER TREATMENT, RECYCLING,
0865 PATENT, EMULSIONS, WASTEWATER TREATMENT, PETROLEUM PRODUCTS,
0869 PATENT, DESIGN-ENGINEERING, WASTEWATER TREATMENT, *FIBER AGGREGATES,
0874 PATENT, OIL-WATER SEPARATION, LUBRICATING OIL, *OIL REMOVAL, WASTE OIL TREATMENT,
0875 PATENT, FLOTATION, FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT,
0880 PATENT, OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING,
0881 PATENT, OIL-WATER SEPARATION, FRESHWATER, FILTRATION , CONTAMINANTS,
0882 PATENT, OIL-WATER SEPARATION, FILTRATION , DISPERSANTS,
0884 PATENT, OIL-WATER SEPARATION, ABSORPTION, SORBENTS,
0891 PATENT, OIL-WATER SEPARATION, EQUIPMENT, SOLID WASTES, *SLURRIES,
0892 PATENT, OIL-WATER SEPARATION, HYDROCARBONS , AROMATIC HYDROCARBONS, *MEMBRANES,
0893 PATENT, OIL-WATER SEPARATION, FLOTATION, FLOCCULATION, FILTRATION , WASTEWATER TREATMENT,
0894 PATENT, OIL-WATER SEPARATION, EQUIPMENT, EMULSIONS, DESIGN-ENGINEERING, *ELECTRIC TREATMENT,
0895 PATENT, OIL-WATER SEPARATION, SORBENTS, *PLASTICS,
0897 PATENT, OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, BILGES, ADSORPTION, WASTEWATERS, SEAWATER,
0898 PATENT, OIL-WATER SEPARATION, EQUIPMENT, EMULSIONS,
0899 PATENT, OIL-WATER SEPARATION, OIL TANKS, WASTE OIL, TANKERS, *WASTE CLAY,
0902 PATENT, OIL-WATER SEPARATION, FILTRATION , DESIGN-ENGINEERING, WASTEWATERS,
0903 PATENT, OIL-WATER SEPARATION, HYDROCARBONS , EQUIPMENT,
0904 PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING, SLUDGE

0905 PATENT, OIL-WATER SEPARATION, ADSORPTION, SORBENTS,
0906 PATENT, OIL-WATER SEPARATION, LUBRICATING OIL, ADSORPTION,
0907 PATENT, OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, *SORBENT GAUZE,
0908 PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, DESIGN-ENGINEERING,
0909 PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, ADSORPTION, WASTEWATERS,
0916 PATENT, WASTE OIL TREATMENT, *SOLID FUEL, REUSE,
0918 PATENT, WASTE OIL, RECLAMATION, REFINING,
0919 PATENT, EXTRACTION, CRANKCASE OIL, WASTE OIL TREATMENT, RECLAMATION,
0929 PATENT, OFFSHORE DRILLING, EQUIPMENT, POLLUTION PREVENTION, PLATFORMS,
1070 PATENT, MICROORGANISMS, BIODEGRADATION, PETROLEUM PRODUCTS, *NUTRIENTS,
0920 PERSONNEL TRAINING, OIL SPILLS, MANUALS, API, STATISTICS,
0921 PERSONNEL TRAINING, OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING, PLATFORMS, TANKERS, SHIPS, SAFETY,
0842 PETROCHEMICALS, MANUALS, INDUSTRIES, WASTEWATER TREATMENT, REFINING,
0845 PETROCHEMICALS, INDUSTRIES, REFINERIES, WASTEWATER TREATMENT,
0848 PETROCHEMICALS, AROMATIC HYDROCARBONS, ADSORPTION, WASTEWATER TREATMENT, *ACTIVATED CARBON,
R140 PETROCHEMICALS, OCEANS, FATE, DISTRIBUTION, BIOGENIC HYDROCARBONS, SEDIMENTATION,
0717 PETROLEUM PRODUCTS, OIL SPILLS, OIL INDUSTRY, EUROPE, PIPELINES, STATISTICS,
0718 PETROLEUM PRODUCTS, OIL SPILLS, CANADA, STATISTICS, *NATES DATABASE,
0755 PETROLEUM PRODUCTS, PATENT, EQUIPMENT, SAMPLING,
0761 PETROLEUM PRODUCTS, GROUNDWATER, ANALYTICAL TECHNIQUES, WASTEWATERS,
0765 PETROLEUM PRODUCTS, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, *GRAVIMETRY,
0767 PETROLEUM PRODUCTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WASTEWATERS,
0816 PETROLEUM PRODUCTS, PATENT, DISPERSANTS, SPILL CLEANUP,
0865 PETROLEUM PRODUCTS, PATENT, EMULSIONS, WASTEWATER TREATMENT,
0870 PETROLEUM PRODUCTS, SORBENTS, WASTEWATER TREATMENT, *POLYURETHANE FOAM,
0890 PETROLEUM PRODUCTS, OIL-WATER SEPARATION, FILTRATION , EMULSIONS,
0936 PETROLEUM PRODUCTS, WASTEWATERS, POLLUTION CONTROL, USSR, RIVERS, *URAL RIVER,
0939 PETROLEUM PRODUCTS, POLLUTION PREVENTION, SPILL CLEANUP,
0970 PETROLEUM PRODUCTS, MORTALITY, DISPERSANTS, ARCTIC, PHYTOPLANKTON, *COREXIT 7664, *DIPROKSAMIN 157,
0980 PETROLEUM PRODUCTS, MICROORGANISMS, DISPERSANTS, BACTERIA, *DIPROKSAMIN 157, *COREXIT 7664,
1028 PETROLEUM PRODUCTS, HYDROCARBONS , CONTAMINATION, BEACHES, SEAWATER, SOIL, USSR,
1038 PETROLEUM PRODUCTS, HEALTH HAZARDS, DISPOSAL , CRUDE OIL, CONTAMINANTS, WASTE OIL, *TRACE METALS, *ASPHALT,
1041 PETROLEUM PRODUCTS, HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, CRUDE OIL, CONTAMINANTS, WASTE OIL, *TRACE METALS,
1070 PETROLEUM PRODUCTS, PATENT, MICROORGANISMS, BIODEGRADATION, *NUTRIENTS,
1081 PETROLEUM PRODUCTS, BIODEGRADATION, BACTERIA, SEAWATER,
1097 PETROLEUM PRODUCTS, MODELS, FUELS , EVAPORATION, CRUDE OIL, *EQUATIONS,
1121 PETROLEUM PRODUCTS, OXIDATION, MODELS, SURFACTANTS, SEAWATER, *PHENOLS, *O2 REGIMES,
1162 PETROLEUM PRODUCTS, INDUSTRIES, GASOLINE, STATISTICS, TOXICITY, *TOXICOLOGICAL LABORATORY,
1171 PETROLEUM PRODUCTS, INDUSTRIES, ENVIRONMENTAL EFFECTS, PRODUCTION , *IMPACT MAPS,
1173 PETROLEUM PRODUCTS, GROUNDWATER, *LEACHING, *SALT DEPOSITS,
0832 PH CONTROL, LUBRICATING OIL, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT,
0847 PH CONTROL, HYDROCARBONS , CONTAMINATION, WASTEWATER TREATMENT, REFINERIES, *COAGULATION,
0901 PH CONTROL, OIL-WATER SEPARATION, FILTRATION , EMULSIONS,
1072 PH CONTROL, MICROORGANISMS, FUEL OIL, BIOMASS, BIODEGRADATION, *DEVIATIONS, *ALKALI CONSUMPTION,
R137 PHYSICAL EFFECTS, OIL SLICKS, MODELS, EMULSIONS, DISPERSIONS, CHEMICAL EFFECTS, *WAVE ACTION,
0748 PHYTOPLANKTON, HYDROCARBONS , GROWTH, BIOASSAY, UPTAKE, *EXPERIMENTAL DESIGN, *BENZENE,
0774 PHYTOPLANKTON, GROWTH, FUEL OIL, CHEMICAL ANALYSIS, ALGAE, WSF, TOXICITY,
0967 PHYTOPLANKTON, DISPERSANTS, CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, *COREXIT, *PRIMARY PRODUCTION,
0970 PHYTOPLANKTON, PETROLEUM PRODUCTS, MORTALITY, DISPERSANTS, ARCTIC, *COREXIT 7664, *DIPROKSAMIN 157,
0975 PHYTOPLANKTON, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS,
0999 PHYTOPLANKTON, DISPERSANTS, CRUDE OIL, TOXICITY, SEAWATER, *CARBON FIXATION, *COREXIT 9527,
1033 PHYTOPLANKTON, OCEANS, CONTAMINATION, BIOLOGICAL EFFECTS, SOURCES, *RATE OF INPUT,
R082 PHYTOPLANKTON, GROWTH, FISH, BIOASSAY, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, WATER QUALITY,
R089 PHYTOPLANKTON, MONITORING, BALLAST , TOXICITY, ALASKA,
R117 PHYTOPLANKTON, LOUISIANA, ESTUARIES, ENVIRONMENTAL EFFECTS, DRILLING , *CARBON FLUX,
0713 PIPELINES, LEAKAGE, WASTEWATERS, REFINERIES, *CONCAWE,
0717 PIPELINES, PETROLEUM PRODUCTS, OIL SPILLS, OIL INDUSTRY, EUROPE, STATISTICS,
0935 PIPELINES, OIL TANKS, MONITORING, LEAKAGE, EQUIPMENT, PRODUCT INFORMATION, *ACOUSTIC EMISSION MONITOR,

1167 PIPELINES, OIL TERMINALS, ENVIRONMENTAL EFFECTS, CANADA,
R079 PIPELINES, OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING, POLLUTION PREVENTION,
R114 PIPELINES, OIL TRANSPORT, HABITATS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BIRDS, ALASKA, *WETLAND RESOURCES,
R115 PIPELINES, MARINE MAMMALS, HABITATS, FOOD WEB, DEVELOPMENT , ARCTIC, ANIMALS,
1064 PLANKTON , OFFSHORE DEVELOPMENT, OCS, INTERTIDAL ZONE, FISH, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA,
R098 PLANTS, FATE, ENVIRONMENTAL EFFECTS, DECOMPOSITION, CRUDE OIL, ARCTIC, *TUNDRA,
R102 PLANTS, MARSHES, CRUDE OIL, BIOLOGICAL EFFECTS, SEDIMENTS, *NITROGEN FLUX, *SPARTINA ALTERNIFLORA,
0778 PLATFORMS, OIL TRANSFER, OIL SPILLS, NORWAY, DETECTION, SOURCE IDENTIFICATION, *LASER SYSTEM,
0921 PLATFORMS, PERSONNEL TRAINING, OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING, TANKERS, SHIPS, SAFETY,
0929 PLATFORMS, PATENT, OFFSHORE DRILLING, EQUIPMENT, POLLUTION PREVENTION,
1164 PLATFORMS, BIRDS, *FIELD OBSERVATIONS,
0712 POLLUTION CONTROL, OIL SPILLS, MEDITERRANEAN SEA, CONTAMINATION,
0844 POLLUTION CONTROL, DESIGN-ENGINEERING, WASTEWATER TREATMENT, REFINERIES, *TAIWAN,
0910 POLLUTION CONTROL, WASTE OIL, RECLAMATION, RECYCLING,
0928 POLLUTION CONTROL, OIL TRANSFER, OIL SPILLS, ENVIRONMENTAL EFFECTS, DELAWARE BAY, CONTINGENCY PLANNING,
0932 POLLUTION CONTROL, LEGISLATION, WASTEWATER TREATMENT, REFINING, US,
0933 POLLUTION CONTROL, EQUIPMENT, DISPERSANTS, CANADA, SPILL CLEANUP, *DISPERSANT TECHNOLOGY,
0936 POLLUTION CONTROL, PETROLEUM PRODUCTS, WASTEWATERS, USSR, RIVERS, *URAL RIVER,
0937 POLLUTION CONTROL, OIL SLICKS, LUBRICATING OIL, DISPOSAL , POLLUTION PREVENTION, REUSE,
0938 POLLUTION CONTROL, OIL INDUSTRY, REFINERIES, SOURCES, REGULATIONS,
1036 POLLUTION CONTROL, ANALYTICAL TECHNIQUES, WASTEWATER TREATMENT, *REVIEW,
1045 POLLUTION CONTROL, OIL TRANSPORT, OFFSHORE DEVELOPMENT, OCS, LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS,
1048 POLLUTION CONTROL, OIL INDUSTRY, OIL FIELDS, HEALTH HAZARDS, GROUNDWATER, SOURCES,
1057 POLLUTION CONTROL, OIL SHALE, EIS, DEVELOPMENT , BASELINE STUDIES, RESOURCE MANAGEMENT,
1127 POLLUTION CONTROL, LEGISLATION, TOXICITY, *FEDERAL WATER POLLUTION CONTROL ACT,
1130 POLLUTION CONTROL, LIABILITY, LEGISLATION, US, *CLEAN WATER ACT 1977,
1138 POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, LEGISLATION, UK,
1153 POLLUTION CONTROL, ESTUARIES, ENVIRONMENTAL EFFECTS, DEVELOPMENT , COASTS, BIBLIOGRAPHIES,
1159 POLLUTION CONTROL, OCEANS, WASTEWATER TREATMENT, SOLID WASTES, SAFETY, *REVIEW,
1168 POLLUTION CONTROL, EUROPE, EQUIPMENT, INDUSTRY, *DIRECTORY,
1174 POLLUTION CONTROL, BIOLOGICAL EFFECTS, ARCTIC, POLLUTION PREVENTION, *RESEARCH PROPOSALS, *AMOP,
R077 POLLUTION CONTROL, LEAKAGE, EQUIPMENT, DESIGN-ENGINEERING, SURVEILLANCE, SAFETY, *REMOTE CONTROL HOVERCRAFT,
R085 POLLUTION CONTROL, OIL DISCHARGES, CHEMICAL EFFECTS, SOURCES, *MILITARY INSTALLATIONS,
R086 POLLUTION CONTROL, OIL SLICKS, USN, SHIPS, SEA SURFACE, *INTERFACE CHEMISTRY,
R147 POLLUTION CONTROL, OIL INDUSTRY, EPA, API, WATER QUALITY, STATISTICAL ANALYSIS,
0734 POLLUTION PREVENTION, OIL-WATER SEPARATION, MONITORING, INCINERATION, BALLAST , SHIPS, WASTEWATERS,
0802 POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, BOOMS, SPILL CLEANUP, SKIMMERS,
0820 POLLUTION PREVENTION, TANKERS, SAFETY, *DOUBLE BOTTOMS,
0821 POLLUTION PREVENTION, OIL DISCHARGES, IMCO, CRUDE OIL WASHING, TANKERS, *LOAD-ON-TOP,
0823 POLLUTION PREVENTION, EQUIPMENT, DESIGN-ENGINEERING, TANKERS, SAFETY, *DESTATOR DEVICE,
0824 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, AMOCO CADIZ SPILL, TANKERS, SEGREGATED BALLAST, SAFETY,
0843 POLLUTION PREVENTION, OIL INDUSTRY, GUIDELINES, CANADA, WASTEWATERS, REFINERIES, REGULATIONS,
0925 POLLUTION PREVENTION, MONITORING, BILGES, BALLAST , PRODUCT INFORMATION, SPILL REMOVAL,
0926 POLLUTION PREVENTION, OIL SPILLS, CONTINGENCY PLANNING, *HONG KONG,
0927 POLLUTION PREVENTION, SHIPS, PRODUCT INFORMATION, *LUBRICATION, *SEALING SYSTEMS,
0929 POLLUTION PREVENTION, PLATFORMS, PATENT, OFFSHORE DRILLING, EQUIPMENT,
0930 POLLUTION PREVENTION, OIL INDUSTRY, SAFETY,
0931 POLLUTION PREVENTION, OFFSHORE DRILLING, OCS, MODELS, DISPOSAL , ATLANTIC COAST, RESOURCE MANAGEMENT, *WORKSHOP,
0934 POLLUTION PREVENTION, TANKERS, SAFETY, *STATIC ELECTRICITY,
0937 POLLUTION PREVENTION, POLLUTION CONTROL, OIL SLICKS, LUBRICATING OIL, DISPOSAL , REUSE,
0939 POLLUTION PREVENTION, PETROLEUM PRODUCTS, SPILL CLEANUP,
1031 POLLUTION PREVENTION, MEDITERRANEAN SEA, ENVIRONMENTAL DETERIORATION,
1126 POLLUTION PREVENTION, LEGISLATION, IMCO, REGULATIONS, TANKERS, US,
1135 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, SEGREGATED BALLAST,
1136 POLLUTION PREVENTION, LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, REGULATIONS, *LAW OF THE SEA,
1137 POLLUTION PREVENTION, MEDITERRANEAN SEA, ISRAEL, COASTS, RESOURCE MANAGEMENT,
1140 POLLUTION PREVENTION, OIL INDUSTRY, EUROPE, REGULATIONS,
1145 POLLUTION PREVENTION, IMCO, CRUDE OIL WASHING, TANKERS, SEGREGATED BALLAST,
1147 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, GUIDELINES, ECONOMICS, SHIPS,

1148 POLLUTION PREVENTION, IMCO, GUIDELINES, ECONOMICS, DESIGN-ENGINEERING, TANKERS,
1149 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, CRUDE OIL WASHING, TANKERS, SEGREGATED BALLAST,
1150 POLLUTION PREVENTION, LIABILITY, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, CONTINGENCY PLANNING, COMPENSATION, US,
1157 POLLUTION PREVENTION, OFFSHORE PRODUCTION, EQUIPMENT, SAFETY, *ACCREDITATION, *TESTING LABORATORIES,
1158 POLLUTION PREVENTION, OFFSHORE PRODUCTION, EQUIPMENT, SAFETY, *QUALITY ASSURANCE, *CERTIFICATION,
1174 POLLUTION PREVENTION, POLLUTION CONTROL, BIOLOGICAL EFFECTS, ARCTIC, *RESEARCH PROPOSALS, *AMOP,
R076 POLLUTION PREVENTION, MANUALS, ENVIRONMENTAL PROTECTION, DISPERSANTS, BIRDS, SPILL REMOVAL, SAFETY,
R079 POLLUTION PREVENTION, PIPELINES, OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING,
R087 POLLUTION PREVENTION, OIL SPILLS, FATE, BEHAVIOR, SOURCE IDENTIFICATION, SPILL CLEANUP, SURVEILLANCE,
0988 POLYCHAETES, GROWTH, FUEL OIL, WSF, SUBLETHAL EFFECTS, REPRODUCTION, *NEANTHES ARENACEODENTATA,
1082 POLYCHAETES, METABOLISM, HYDROCARBONS , CRUSTACEANS, BIODEGRADATION, *CALLINECTES SAPIDUS, *NEREIS SP., *ARYL HYDROCARBON HYDROXYLASE,
1108 POLYCHAETES, BIOLOGICAL EFFECTS, WEATHERING, SEDIMENTS, *ARENICOLA MARINA,
1047 PORTS , OIL TERMINALS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, UK, TANKERS, *OCEAN MANAGEMENT, *PROCEEDINGS,
1128 PORTS , OCS, LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, REGULATIONS, STATE GOVERNMENTS, TANKERS,
1154 PORTS , OIL SPILLS, ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, *SUPERTANKERS,
1155 PORTS , ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, TANKERS, *SUPERTANKERS,
0770 PRODUCT INFORMATION, CHEMICAL ANALYSIS, *TELEDYNE ANALYTICAL INSTRUMENTS,
0783 PRODUCT INFORMATION, BOOMS, SPILL CONTAINMENT, *VATOR OY CO,
0805 PRODUCT INFORMATION, EQUIPMENT, SKIMMERS, *BRILL OIL SKIMMER,
0811 PRODUCT INFORMATION, DESIGN-ENGINEERING, SKIMMERS, SPILL REMOVAL, USCG, *ZRV SKIMMER,
0852 PRODUCT INFORMATION, SKIMMERS, WASTEWATER TREATMENT,
0886 PRODUCT INFORMATION, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, SPILL REMOVAL, *ENQUIP INC,
0888 PRODUCT INFORMATION, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, COALESCENCE,
0889 PRODUCT INFORMATION, OIL-WATER SEPARATION, EPA, COALESCENCE, REUSE, REGULATIONS,
0896 PRODUCT INFORMATION, OIL-WATER SEPARATION, MONITORING, GRAVITY SEPARATION,
0900 PRODUCT INFORMATION, OIL-WATER SEPARATION, SPILL REMOVAL, *OIL RECOVERY SYSTEMS INC,
0925 PRODUCT INFORMATION, POLLUTION PREVENTION, MONITORING, BILGES, BALLAST , SPILL REMOVAL,
0927 PRODUCT INFORMATION, POLLUTION PREVENTION, SHIPS, *LUBRICATION, *SEALING SYSTEMS,
0935 PRODUCT INFORMATION, PIPELINES, OIL TANKS, MONITORING, LEAKAGE, EQUIPMENT, *ACOUSTIC EMISSION MONITOR,
1171 PRODUCTION , PETOLEUM PRODUCTS, INDUSTRIES, ENVIRONMENTAL EFFECTS, *IMPACT MAPS,
R078 PRODUCTION , OILTRANSPORT, ENVIRONMENTAL PROTECTION, PUGET SOUND,
0985 PRUDHOE BAY, MORTALITY, GROWTH, FISH, CRUDE OIL, BIOASSAY, ACUTE EFFECTS, *ONCORHYNCHUS GORBUSCHA,
0986 PRUDHOE BAY, PAH INVERTEBRATES, HYDROCARBONS , CRUDE OIL, UPTAKE, SEDIMENTS,
0987 PRUDHOE BAY, MOLUSKS, CRUDE OIL, UPTAKE, *NAPHTHALENES, SEDIMENTS, *MACOMA INQUINATA,
1061 PUGET SOUND, MODLS, HYDROCARBONS , BASELINE STUDIES, SAMPLING,
R078 PUGET SOUND, PROUCTION , OIL TRANSPORT, ENVIRONMENTAL PROTECTION,
R123 PUGET SOUND, MODLS, MARINE ORGANISMS, HYDROCARBONS , ENVIRONMENTAL MANAGEMENT, DEVELOPMENT ,BASELINE STUDIES,
0872 RECLAMATION, LUBICATING OIL, DISPOSAL , CARCINOGENS, AROMATIC HYDROCARBONS, WASTE OIL, REFINING
0910 RECLAMATION, POLUTION CONTROL, WASTE OIL, RECYCLING,
0913 RECLAMATION, LUBICATING OIL, RECYCLING, SOLVENTS,
0918 RECLAMATION, PATNT, WASTE OIL, REFINING,
0919 RECLAMATION, PATNT, EXTRACTION, CRANKCASE OIL, WASTE OIL TREATMENT,
R084 RECLAMATION, OIL-WATER SEPARATION, OIL TANKS, DESIGN-ENGINEERING, STORAGE, USN, *TANK CLEANING,
0942 RECOVERY, MARINE ORGANISMS, HYDROCARBONS , CHRONIC EFFECTS, BIOLOGICAL EFFECTS, SEDIMENTS,
0972 RECOVERY, MARSHES, FUEL OIL, CRUSTACEANS, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, *UCA PUGNAX,
0996 RECOVERY, FLORIDA SPILL, FISH, CONTAMINATION, BUZZARDS BAY, BIOLOGICAL EFFECTS, *FUNDULUS HETEROCLITUS,
1003 RECOVERY, CONTAMINATION, BIRDS, AMOCO CADIZ SPILL, TORREY CANYON SPILL,
1004 RECOVERY, MORTALITY, CONTAMINATION, BIRDS, BALTIC SEA,
1006 RECOVERY, ENVIRONMENTAL DETERIORATION, ECOSYSTEMS, RESOURCE MANAGEMENT,
1008 RECOVERY, MARSHES, INVERTEBRATES, FUEL OIL, BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS, RESTORATION,
1010 RECOVERY, DISTRIBUTION, CHRONIC EFFECTS, BIOMASS, BENTHOS, REFINERIES, WASTEWATER TREATMENT, *RECOLONIZATION,
1012 RECOVERY, INTERTIDAL ZONE, ECOSYSTEMS, CHRONIC EFFECTS, *SYMPOSIUM SUMMARY,

1014 RECOVERY, MARINE ORGANISMS, INTERTIDAL ZONE, CHRONIC EFFECTS, BALTIC SEA, *FUCUS VESICULOSUS, *IRINI SPILL,
1015 RECOVERY, FUEL OIL, CONTAMINATION, ANTARCTICA, STATISTICAL ANALYSIS,
1016 RECOVERY, MARINE ORGANISMS, DISPERSANTS, BEACH CLEANUP, *RECOLONIZATION, SHORELINES, TORREY CANYON SPILL, UK,
1017 RECOVERY, INTERTIDAL ZONE, FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, *PROCEEDINGS,
1018 RECOVERY, MICROORGANISMS, DISTRIBUTION, CHEDABUCTO BAY, BIODEGRADATION, BACTERIA, SEDIMENTS,
1019 RECOVERY, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS,
1020 RECOVERY, OCEANS, ENVIRONMENTAL DETERIORATION, CONSERVATION, RESOURCE MANAGEMENT,
1101 RECOVERY, FATE, BIODEGRADATION, WEATHERING, *SYMPOSIUM SUMMARY,
R111 RECOVERY, MARSHES, FOOD WEB, ESTUARIES, CRUDE OIL, CHEMICAL EFFECTS, ACUTE EFFECTS,
R113 RECOVERY, MASSACHUSETTS, MARSHES, GROWTH, FUEL OIL, ENVIRONMENTAL EFFECTS,
0829 RECYCLING, CONTAMINANTS, WASTEWATER TREATMENT, REFINERIES,
0837 RECYCLING, INDUSTRIES, DISPOSAL , WASTE OIL,
0864 RECYCLING, PATENT, FILTRATION , WASTEWATER TREATMENT,
0910 RECYCLING, RECLAMATION, POLLUTION CONTROL, WASTE OIL,
0912 RECYCLING, LEGISLATION, INDUSTRIES, CRANKCASE OIL, WASTE OIL, REUSE, *PROCEEDINGS,
0913 RECYCLING, RECLAMATION, LUBRICATING OIL, SOLVENTS,
0914 RECYCLING, OIL INDUSTRY, ENVIRONMENTAL MANAGEMENT, ECONOMICS, DISPOSAL , WASTE OIL, REFINING,
0915 RECYCLING, INDUSTRIES, GOVERNMENT AGENCIES, WASTE OIL,
0917 RECYCLING, LUBRICATING OIL, LEGISLATION, GOVERNMENT AGENCIES, WASTE OIL, RESOURCE MANAGEMENT, US,
0713 REFINERIES, PIPELINES, LEAKAGE, WASTEWATERS, *CONCAWE,
0727 REFINERIES, OIL TERMINALS, MONITORING, ENVIRONMENTAL DETERIORATION, UK,
0825 REFINERIES, EUROPE, WASTEWATER TREATMENT, WATER QUALITY, STATISTICS,
0827 REFINERIES, OXIDATION, BIOLOGICAL TREATMENT, WASTEWATER TREATMENT, *AERATION,
0829 REFINERIES, RECYCLING, CONTAMINANTS, WASTEWATER TREATMENT,
0838 REFINERIES, FLOTATION, FILTRATION , WASTEWATER TREATMENT, *PILOT STUDY, *MICROSCREENING,
0843 REFINERIES, POLLUTION PREVENTION, OIL INDUSTRY, GUIDELINES, CANADA, WASTEWATERS, REGULATIONS,
0844 REFINERIES, POLLUTION CONTROL, DESIGN-ENGINEERING, WASTEWATER TREATMENT, *TAIWAN,
0845 REFINERIES, PETROCHEMICALS, INDUSTRIES, WASTEWATER TREATMENT,
0847 REFINERIES, PH CONTROL, HYDROCARBONS , CONTAMINATION, WASTEWATER TREATMENT, *COAGULATION,
0855 REFINERIES, OXIDATION, CONSERVATION, WASTEWATER TREATMENT, REUSE, *BIOOXIDATION,
0871 REFINERIES, OIL INDUSTRY, ACTIVATED SLUDGE, *ACTIVATED CARBON, *EFFLUENT QUALITY,
0879 REFINERIES, WASTEWATER TREATMENT, SOLID WASTES,
0883 REFINERIES, OIL-WATER SEPARATION, COALESCENCE, WASTEWATER TREATMENT, *FIBROUS BEDS,
0936 REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, SOURCES, REGULATIONS,
0975 REFINERIES, PHYTOPLANKTON, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, WASTEWATERS,
1010 REFINERIES, RECOVERY, DISTRIBUTION, CHRONIC EFFECTS, BIOMASS, BENTHOS, WASTEWATER TREATMENT, *RECOLONIZATION,
1077 REFINERIES, INCINERATION, DISPOSAL , BIODEGRADATION, SLUDGE , SOIL, *LAND FARMING,
1131 REFINERIES, LEGISLATION, EPA, WASTEWATER TREATMENT, *CLEAN WATER ACT 1977,
1172 REFINERIES, BIOASSAY, TOXICITY, WATER QUALITY, WASTEWATERS, *DAPHNIA,
R062 REFINERIES, EPA, API, SOLID WASTES, TOXICITY, SLUDGE , *TANK CLEANING, WATER QUALITY,
R063 REFINERIES, ACTIVATED SLUDGE, WASTEWATERS, SAMPLING, *RESIDUALS, *PNA,
R064 REFINERIES, CONTAMINANTS, ANALYTICAL TECHNIQUES, WASTEWATERS, TOXICITY, SAMPLING,
R065 REFINERIES, INVERTEBRATES, INTERTIDAL ZONE, FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES, TOXICITY, WASTEWATERS,
R080 REFINERIES, DISPOSAL , SOLID WASTES, REGULATIONS, WASTEWATER TREATMENT, *DATA BASE,
R082 REFINERIES, PHYTOPLANKTON, GROWTH, FISH, BIOASSAY, ACTIVATED SLUDGE, WASTEWATER TREATMENT, WATER QUALITY,
R108 REFINERIES, PACIFIC OCEAN, MOLLUSKS, CRUSTACEANS, BIOLOGICAL EFFECTS, BIOINDICATORS, WASTEWATERS,
R149 REFINERIES, MODELS, GUIDELINES, EPA, COST ANALYSIS, API, STATISTICAL ANALYSIS, WASTEWATERS,
0830 REFINING, INDUSTRIES, EQUIPMENT, EMULSIONS, ECONOMICS, WASTE OIL TREATMENT, *TECHNOLOGY REVIEW,
0842 REFINING, PETROCHEMICALS, MANUALS, INDUSTRIES, WASTEWATER TREATMENT,
0872 REFINING, RECLAMATION, LUBRICATING OIL, DISPOSAL , CARCINOGENS, AROMATIC HYDROCARBONS, WASTE OIL,
0914 REFINING, RECYCLING, OIL INDUSTRY, ENVIRONMENTAL MANAGEMENT, ECONOMICS, DISPOSAL , WASTE OIL,
0918 REFINING, RECLAMATION, PATENT, WASTE OIL,
0932 REFINING, POLLUTION CONTROL, LEGISLATION, WASTEWATER TREATMENT, US,
R083 REFINING, INDUSTRIES, WASTEWATER TREATMENT, *LAND APPLICATION,
0822 REGULATIONS, OCEANS, IMCO, RESOURCE MANAGEMENT, TANKERS, TORREY CANYON SPILL,
0843 REGULATIONS, REFINERIES, POLLUTION PREVENTION, OIL INDUSTRY, GUIDELINES, CANADA, WASTEWATERS,
0889 REGULATIONS, PRODUCT INFORMATION, OIL-WATER SEPARATION, EPA, COALESCENCE, REUSE,

0938 REGULATIONS, REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, SOURCES,
1126 REGULATIONS, POLLUTION PREVENTION, LEGISLATION, IMCO, TANKERS, US,
1128 REGULATIONS, PORTS , OCS, LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, STATE GOVERNMENTS, TANKERS,
1136 REGULATIONS, POLLUTION PREVENTION, LEGISLATION, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, *LAW OF THE SEA,
1140 REGULATIONS, POLLUTION PREVENTION, OIL INDUSTRY, EUROPE,
R080 REGULATIONS, REFINERIES, DISPOSAL , SOLID WASTES, WASTEWATER TREATMENT, *DATA BASE,
R148 REGULATIONS, COST ANALYSIS, API, ENVIRONMENTAL PROTECTION,
0747 RELEASE, INTERTIDAL ZONE, HYDROCARBONS , CHROMATOGRAPHY, BENTHOS, SEDIMENTS, *RECRUITMENT,
0948 RELEASE, MOLLUSKS, HYDROCARBONS , CHRONIC EFFECTS, UPTAKE, RIVERS, *MERCENARIA MERCENARIA,
0963 RELEASE, MARINE ORGANISMS, HYDROCARBONS ,
0994 RELEASE, MOLLUSKS, BEHAVIOR, FUEL OIL, TOXICITY, UPTAKE, *RESPIRATION, *MYA ARENARIA,
0995 RELEASE, MOLLUSKS, HYDROCARBONS , FUEL OIL, SUBLETHAL EFFECTS, UPTAKE, *RESPIRATION RATES, *MYA ARENARIA,
1104 RELEASE, PAH, MARINE ORGANISMS, HYDROCARBONS , FOOD WEB, BIODEGRADATION, SOURCES, UPTAKE,
R101 RELEASE, HYDROCARBONS , GROWTH, FOOD WEB, CORAL REEFS, *DRILLING MUD, UPTAKE, SEDIMENTATION,
0728 REMOTE SENSING, MONITORING, CHEMICAL ANALYSIS, *FLUOROMETRY,
0735 REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, *LUMINESCENCE, *FRAUNHOFER LINE DISCRIMINATOR,
0736 REMOTE SENSING, MONITORING, LEGISLATION, EUROPE, SURVEILLANCE, *SATELLITES,
0737 REMOTE SENSING, MONITORING, ESTUARIES, DETECTION, COASTS,
0738 REMOTE SENSING, MODELS, DRIFT, DELAWARE BAY, SPREADING, *DENSITY FRONTS, *SATELLITES, *LANDSAT,
0739 REMOTE SENSING, DETECTION, *LASER-INDUCED FLUORESCENCE,
0740 REMOTE SENSING, MONITORING, FOSSIL FUELS, ENVIRONMENTAL EFFECTS, DEVELOPMENT , BOOK REVIEW,
0962 REPRODUCTION, FUEL OIL, WSF, TOXICITY, COPEPODS, *TIGRIOPUS JAPONICUS,
0988 REPRODUCTION, POLYCHAETES, GROWTH, FUEL OIL, WSF, SUBLETHAL EFFECTS, *NEANTHES ARENACEODENTATA,
0822 RESOURCE MANAGEMENT, REGULATIONS, OCEANS, IMCO, TANKERS, TORREY CANYON SPILL,
0911 RESOURCE MANAGEMENT, LEGISLATION, ILLINOIS, WASTE OIL, *PROCEEDINGS,
0917 RESOURCE MANAGEMENT, RECYCLING, LUBRICATING OIL, LEGISLATION, GOVERNMENT AGENCIES, WASTE OIL, US,
0931 RESOURCE MANAGEMENT, POLLUTION PREVENTION, OFFSHORE DRILLING, OCS, MODELS, DISPOSAL , ATLANTIC COAST, *WORKSHOP,
1006 RESOURCE MANAGEMENT, RECOVERY, ENVIRONMENTAL DETERIORATION, ECOSYSTEMS,
1020 RESOURCE MANAGEMENT, RECOVERY, OCEANS, ENVIRONMENTAL DETERIORATION, CONSERVATION,
1049 RESOURCE MANAGEMENT, OIL TRANSPORT, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS,
1051 RESOURCE MANAGEMENT, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, GEORGES BANK, FISHERIES, ENVIRONMENTAL EFFECTS,
1057 RESOURCE MANAGEMENT, POLLUTION CONTROL, OIL SHALE, EIS, DEVELOPMENT , BASELINE STUDIES,
1125 RESOURCE MANAGEMENT, COASTAL ZONE MANAGEMENT, API, STATE GOVERNMENTS,
1137 RESOURCE MANAGEMENT, POLLUTION PREVENTION, MEDITERRANEAN SEA, ISRAEL, COASTS,
1143 RESOURCE MANAGEMENT, OIL SHALE, OIL INDUSTRY, GOVERNMENT AGENCIES, FISH, ENVIRONMENTAL PROTECTION, WILDLIFE,
R121 RESOURCE MANAGEMENT, GROUNDWATER, ECONOMIC EFFECTS, DRILLING , CONTAMINATION, ANALYTICAL TECHNIQUES, *ENHANCED OIL RECOVERY , *WATER RESOURCES,
1005 RESTORATION, BOOK REVIEW, BIRDS, API,
1007 RESTORATION, OIL SPILLS, CONSERVATION, BIRDS, TORREY CANYON SPILL,
1008 RESTORATION, RECOVERY, MARSHES, INVERTEBRATES, FUEL OIL, BUZZARDS BAY, BOUCHARD 65 SPILL, BENTHOS,
1009 RESTORATION, OIL SLICKS, MANUALS, BIRDS,
1011 RESTORATION, OIL SPILLS, SPILL REMOVAL, SOIL,
1013 RESTORATION, MANUALS, GUIDELINES, WILDLIFE,
R112 RESTORATION, MARSHES, ENVIRONMENTAL PROTECTION, SHORELINES, *SURFACE TREATMENT AGENTS,
0855 REUSE, REFINERIES, OXIDATION, CONSERVATION, WASTEWATER TREATMENT, *BIOOXIDATION,
0889 REUSE, REGULATIONS, PRODUCT INFORMATION, OIL-WATER SEPARATION, EPA, COALESCENCE,
0912 REUSE, RECYCLING, LEGISLATION, INDUSTRIES, CRANKCASE OIL, WASTE OIL, *PROCEEDINGS,
0916 REUSE, PATENT, WASTE OIL TREATMENT, *SOLID FUEL,
0937 REUSE, POLLUTION PREVENTION, POLLUTION CONTROL, OIL SLICKS, LUBRICATING OIL, DISPOSAL ,
0807 RIVERS, ICE, EQUIPMENT, CANADA, SPILL CLEANUP, SKIMMERS,
0877 RIVERS, NARRAGANSETT BAY, HYDROCARBONS , FATE, ESTUARIES, COASTS, WASTEWATERS, SEDIMENTATION, *PROVIDENCE RIVER,
0936 RIVERS, POLLUTION CONTROL, PETROLEUM PRODUCTS, WASTEWATERS, USSR, *URAL RIVER,
0948 RIVERS, RELEASE, MOLLUSKS, HYDROCARBONS , CHRONIC EFFECTS, UPTAKE, *MERCENARIA MERCENARIA,
1022 RIVERS, CONTAMINANTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, WASTEWATERS, SOURCES,
0782 SAFETY, MANUALS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SAMPLING, USCG, WEATHERING,
0826 SAFETY, POLLUTION PREVENTION, TANKERS, *DOUBLE BOTTOMS,
0823 SAFETY, POLLUTION PREVENTION, EQUIPMENT, DESIGN-ENGINEERING, TANKERS, *DETECTOR DEVICE,

0824 SAFETY, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, AMOCO CADIZ SPILL, TANKERS, SEGREGATED BALLAST,
0921 SAFETY, PLATFORMS, PERSONNEL TRAINING, OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING, TANKERS, SHIPS,
0922 SAFETY, OIL SPILLS, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, TANKERS,
0930 SAFETY, POLLUTION PREVENTION, OIL INDUSTRY,
0934 SAFETY, POLLUTION PREVENTION, TANKERS, *STATIC ELECTRICITY,
1065 SAFETY, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, STATISTICS, ALASKA, *HAZARDS,
1141 SAFETY, OIL SPILLS, ENVIRONMENTAL PROTECTION, AMOCO CADIZ SPILL, TANKERS, *NEGOTIATIONS,
1146 SAFETY, INTERNATIONAL AGREEMENTS, IMCO, CRUDE OIL WASHING, AMOCO CADIZ SPILL, TANKERS, SEGREGATED BALLAST,
1157 SAFETY, POLLUTION PREVENTION, OFFSHORE PRODUCTION, EQUIPMENT, *ACCREDITATION, *TESTING LABORATORIES,
1158 SAFETY, POLLUTION PREVENTION, OFFSHORE PRODUCTION, EQUIPMENT, *QUALITY ASSURANCE, *CERTIFICATION,
1159 SAFETY, POLLUTION CONTROL, OCEANS, WASTEWATER TREATMENT, SOLID WASTES, *REVIEW,
R076 SAFETY, POLLUTION PREVENTION, MANUALS, ENVIRONMENTAL PROTECTION, DISPERSANTS, BIRDS, SPILL REMOVAL,
R077 SAFETY, POLLUTION CONTROL, LEAKAGE, EQUIPMENT, DESIGN-ENGINEERING, SURVEILLANCE, *REMOTE CONTROL HOVERCRAFT,
0741 SAMPLING, CRUDE OIL, CHROMATOGRAPHY, ARGO MERCHANT SPILL, SEDIMENTS, *FIELD METHOD,
0742 SAMPLING, NORWAY, MARINE ORGANISMS, CRUDE OIL, CHEMICAL ANALYSIS, BENTHOS, AROMATIC HYDROCARBONS,
0743 SAMPLING, METABOLISM, MARINE ORGANISMS, HYDROCARBONS , GREENLAND, SEDIMENTS,
0744 SAMPLING, MONITORING, EQUIPMENT, WASTEWATERS, WATER QUALITY,
0745 SAMPLING, CONTAMINATION, ANALYTICAL TECHNIQUES, *NISKIN BOTTLES,
0752 SAMPLING, HYDROCARBONS , CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *TRACE LEVELS,
0755 SAMPLING, PETROLEUM PRODUCTS, PATENT, EQUIPMENT,
0764 SAMPLING, HYDROCARBONS , CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SEDIMENTS, SEAWATER,
0776 SAMPLING, MARINE ORGANISMS, HYDROCARBONS , DISTRIBUTION, SEAWATER, SEDIMENTS,
0781 SAMPLING, CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION, WEATHERING,
0782 SAMPLING, SAFETY, MANUALS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, USCG, WEATHERING,
0876 SAMPLING, OIL-WATER SEPARATION, HYDROCARBONS , WASTEWATER TREATMENT,
1055 SAMPLING, PAH, LAKES , CANADA, BIOGENIC HYDROCARBONS,
1060 SAMPLING, GULF OF MEXICO, DEEPWATER PORTS, BASELINE STUDIES, AROMATIC HYDROCARBONS, SEAWATER, SPECTROSCOPY,
1061 SAMPLING, PUGET SOUND, MODELS, HYDROCARBONS , BASELINE STUDIES,
1103 SAMPLING, DISTRIBUTION, BEACHES, BAHAMAS, TAR,
1112 SAMPLING, MAINE, FATE, CHEMICAL ANALYSIS, WEATHERING, SEDIMENTS, *MYA ARENARIA,
1113 SAMPLING, MICROORGANISMS, INTERTIDAL ZONE, BIODEGRADATION, AROMATIC HYDROCARBONS, YUGOSLAVIA,
R060 SAMPLING, OIL INDUSTRY, GROUNDWATER, CONTAMINATION, SOLID WASTES, *LEACHING TEST,
R061 SAMPLING, OIL SPILLS, BUZZARDS BAY, BIOLOGICAL EFFECTS, BENTHOS, ANALYTICAL TECHNIQUES, *X-RAY RADIOGRAPHY,
R063 SAMPLING, REFINERIES, ACTIVATED SLUDGE, WASTEWATERS, *RESIDUALS, *PMA,
R064 SAMPLING, REFINERIES, CONTAMINANTS, ANALYTICAL TECHNIQUES, WASTEWATERS, TOXICITY,
R074 SAMPLING, EQUIPMENT, DISPERSANTS, SPILL CLEANUP, *APPLICATION,
R107 SAMPLING, NATURAL SEEPAGE, MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS, SEDIMENTS,
1133 SANTA BARBARA CHANNEL, OCS, LIABILITY, LEGISLATION, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS,
R142 SARGASSO SEA, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BENTHOS, SEAWATER, SEDIMENTS, *TRANSPORT ,
0715 SCOTLAND, OIL TERMINALS, NORTH SEA, BIRDS, STATISTICS,
1056 SCOTLAND, EKOFISK BLOWOUT, BIRDS, *SEABIRD POPULATION STUDY,
0794 SEA SURFACE, PATENT, BEACH CLEANUP, ABSORPTION, SPILL REMOVAL,
1116 SEA SURFACE, MODELS, HYDROCARBONS , FATE,
1119 SEA SURFACE, DISPERSIONS, *AIR-WATER INTERFACE, *BURSTING BUBBLES,
R066 SEA SURFACE, POLLUTION CONTROL, OIL SLICKS, USN, SHIPS, *INTERFACE CHEMISTRY,
R133 SEA SURFACE, OCEANS, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, SEDIMENTS, *WATER COLUMN,
0746 SEAWATER, HYDROCARBONS , SPECTROSCOPY,
0756 SEAWATER, HYDROCARBONS , CHEMICAL ANALYSIS,
0763 SEAWATER, DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES,
0764 SEAWATER, SAMPLING, HYDROCARBONS , CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS, SEDIMENTS,
0776 SEAWATER, SAMPLING, MARINE ORGANISMS, HYDROCARBONS , DISTRIBUTION, SEDIMENTS,
0784 SEAWATER, OIL SPILLS, SOURCE IDENTIFICATION, SOURCES, *ORGANIC MATTER,
0897 SEAWATER, PATENT, OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, BILGES, ADSORPTION, WASTEWATERS,
0958 SEAWATER, PHYTOPLANKTON, DISPERSANTS, CRUDE OIL, TOXICITY, *CARBON FIXATION, *COULTER [illegible],
1028 SEAWATER, PETROLEUM PRODUCTS, HYDROCARBONS , CONTAMINATION, BEACHES, SOIL, IRAN,
1060 SEAWATER, SAMPLING, GULF OF MEXICO, DEEPWATER PORTS, BASELINE STUDIES, AROMATIC HYDROCARBONS, SPECTROSCOPY,

1081 SEAWATER, PETROLEUM PRODUCTS, BIODEGRADATION, BACTERIA,
1094 SEAWATER, MICROORGANISMS, CRANKCASE OIL, CHESAPEAKE BAY, CARCINOGENS, BIODEGRADATION, SEDIMENTS,
1102 SEAWATER, HYDROCARBONS , FATE, DISTRIBUTION, CHEMICAL ANALYSIS, BIODEGRADATION, SEDIMENTS, *PROCEEDINGS,
1115 SEAWATER, OIL SPILLS, EVAPORATION, BIODEGRADATION, *KINETICS,
1120 SEAWATER, MODELS, FATE, TAR, *PETROLEUM PARTICLES,
1121 SEAWATER, PETROLEUM PRODUCTS, OXIDATION, MODELS, SURFACTANTS, *PHENOLS,**O2 REGIMES,
R070 SEAWATER, HYDROCARBONS , ANALYTICAL TECHNIQUES, SEDIMENTS, *ANIMAL TISSUES,
R099 SEAWATER, CRUDE OIL, CONTAMINANTS, BACTERIA, SUBLETHAL EFFECTS, MICROORGANISMS, *CHEMOTAXIS,
R139 SEAWATER, HYDROCARBONS , CHEMICAL EFFECTS, SOLUBILITY, USN,
R142 SEAWATER, SARGASSO SEA, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BENTHOS, SEDIMENTS, *TRANSPORT ,
0877 SEDIMENTATION, RIVERS, NARRAGANSETT BAY, HYDROCARBONS , FATE, ESTUARIES, COASTS, WASTEWATERS, *PROVIDENCE RIVER,
1095 SEDIMENTATION, FLOCCULATION, EMULSIONS, ADSORPTION, COAGULATION, *COLLOIDS,
R096 SEDIMENTATION, MONITORING, HYDROCARBONS , ESTUARIES, ENVIRONMENTAL EFFECTS, BIOGENIC HYDROCARBONS, ADSORPTION,
R101 SEDIMENTATION, RELEASE, HYDROCARBONS , GROWTH, FOOD WEB, CORAL REEFS, *DRILLING MUD, UPTAKE,
R110 SEDIMENTATION, DISPERSIONS, COASTS, BEHAVIOR, BEACH CLEANUP, AMOCO CADIZ SPILL, SPILL REMOVAL,
R140 SEDIMENTATION, PETROCHEMICALS, OCEANS, FATE, DISTRIBUTION, BIOGENIC HYDROCARBONS,
0732 SEDIMENTS, MONITORING, FUEL OIL, DETECTION, SOIL, *ELECTRICAL RESISTIVITY,
0741 SEDIMENTS, SAMPLING, CRUDE OIL, CHROMATOGRAPHY, ARGO MERCHANT SPILL, *FIELD METHOD,
0743 SEDIMENTS, SAMPLING, METABOLISM, MARINE ORGANISMS, HYDROCARBONS , GREENLAND,
0747 SEDIMENTS, RELEASE, INTERTIDAL ZONE, HYDROCARBONS , CHROMATOGRAPHY, BENTHOS, *RECRUITMENT,
0753 SEDIMENTS, HYDROCARBONS , GC/MS, BIOGENIC HYDROCARBONS, SOURCE IDENTIFICATION,
0762 SEDIMENTS, FISH, FATE, EKOFISK BLOWOUT, CHEMICAL ANALYSIS,
0764 SEDIMENTS, SEAWATER, SAMPLING, HYDROCARBONS , CHEMICAL ANALYSIS, BIOGENIC HYDROCARBONS,
0769 SEDIMENTS, MARSHES, FUEL OIL, CHROMATOGRAPHY, BUZZARDS BAY, AROMATIC HYDROCARBONS, SPECTROMETRY,
0772 SEDIMENTS, NARRAGANSETT BAY, HYDROCARBONS , CHRONIC EFFECTS, BIOGENIC HYDROCARBONS, SOURCES, *RHODE ISLAND SOUND,
0776 SEDIMENTS, SEAWATER, SAMPLING, MARINE ORGANISMS, HYDROCARBONS , DISTRIBUTION,
0798 SEDIMENTS, PATENT, BEACH CLEANUP, SPILL REMOVAL,
0942 SEDIMENTS, RECOVERY, MARINE ORGANISMS, HYDROCARBONS , CHRONIC EFFECTS, BIOLOGICAL EFFECTS,
0966 SEDIMENTS, OIL SPILLS, MORTALITY, MOLLUSKS, MAINE, CHRONIC EFFECTS, *CLAMS,
0978 SEDIMENTS, FISH, CRUDE OIL, BIOLOGICAL EFFECTS, UPTAKE, TOXICITY, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0986 SEDIMENTS, PRUDHOE BAY, PAH, INVERTEBRATES, HYDROCARBONS , CRUDE OIL, UPTAKE,
0987 SEDIMENTS, PRUDHOE BAY, MOLLUSKS, CRUDE OIL, UPTAKE, *NAPHTHALENES, *MACOMA INQUINATA,
0990 SEDIMENTS, MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, BUZZARDS BAY, BENTHOS, STATISTICAL ANALYSIS,
0998 SEDIMENTS, INTERTIDAL ZONE, HYDROCARBONS , CHEDABUCTO BAY, BIOMASS, BIOLOGICAL EFFECTS,
1018 SEDIMENTS, RECOVERY, MICROORGANISMS, DISTRIBUTION, CHEDABUCTO BAY, BIODEGRADATION, BACTERIA,
1027 SEDIMENTS, MOLLUSKS, CRUDE OIL, ADSORPTION, ABSORPTION, UPTAKE, *OYSTERS,
1053 SEDIMENTS, MEXICO , MARINE ORGANISMS, DISTRIBUTION, BIOGENIC HYDROCARBONS, BASELINE STUDIES, *N-PARAFFINS,
1094 SEDIMENTS, SEAWATER, MICROORGANISMS, CRANKCASE OIL, CHESAPEAKE BAY, CARCINOGENS, BIODEGRADATION,
1102 SEDIMENTS, SEAWATER, HYDROCARBONS , FATE, DISTRIBUTION, CHEMICAL ANALYSIS, BIODEGRADATION, *PROCEEDINGS,
1107 SEDIMENTS, MODELS, FOSSIL FUELS, FATE, ESTUARIES, CONTAMINANTS,
1108 SEDIMENTS, POLYCHAETES, BIOLOGICAL EFFECTS, WEATHERING, *ARENICOLA MARINA,
1109 SEDIMENTS, INTERTIDAL ZONE, FUEL OIL, FATE, CHEDABUCTO BAY, *ARROW SPILL,
1112 SEDIMENTS, SAMPLING, MAINE, FATE, CHEMICAL ANALYSIS, WEATHERING, *MYA ARENARIA,
1117 SEDIMENTS, PAH, ESTUARIES, CRUDE OIL, SOURCES, UK,
R067 SEDIMENTS, OXIDATION, HYDROCARBONS , DELAWARE, CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, UPTAKE, *CHARACTERIZATION,
R070 SEDIMENTS, SEAWATER, HYDROCARBONS , ANALYTICAL TECHNIQUES, *ANIMAL TISSUES,
R075 SEDIMENTS, GASOLINE, SPILL REMOVAL, SURFACTANTS, *UNDERGROUND RECOVERY ,
R102 SEDIMENTS, PLANTS, MARSHES, CRUDE OIL, BIOLOGICAL EFFECTS, *NITROGEN FLUX, *SPARTINA ALTERNIFLORA,
R107 SEDIMENTS, SAMPLING, NATURAL SEEPAGE, MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS,
R119 SEDIMENTS, OIL FIELDS, MARSHES, HYDROCARBONS , GROUNDWATER, CONTAMINATION, BIODEGRADATION,
R127 SEDIMENTS, MARSHES, FUNGI, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA,
R133 SEDIMENTS, SEA SURFACE, OCEANS, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, *WATER COLUMN,

R142 SEDIMENTS, SEAWATER, SARGASSO SEA, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BENTHOS, *TRANSPORT ,
0824 SEGREGATED BALLAST, SAFETY, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, AMOCO CADIZ SPILL, TANKERS,
1135 SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, TANKERS,
1145 SEGREGATED BALLAST, POLLUTION PREVENTION, IMCO, CRUDE OIL WASHING, TANKERS,
1146 SEGREGATED BALLAST, SAFETY, INTERNATIONAL AGREEMENTS, IMCO, CRUDE OIL WASHING, AMOCO CADIZ SPILL, TANKERS,
1149 SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, CRUDE OIL WASHING, TANKERS,
0734 SHIPS, POLLUTION PREVENTION, OIL-WATER SEPARATION, MONITORING, INCINERATION, BALLAST , WASTEWATERS,
0806 SHIPS, PATENT, EQUIPMENT, BOOMS, SPILL CONTAINMENT, SPILL REMOVAL,
0849 SHIPS, PATENT, FLOTATION, WASTEWATER TREATMENT, *ELECTROLYSIS,
0867 SHIPS, OIL-WATER SEPARATION, INCINERATION, FLOTATION, FILTRATION , WASTEWATER TREATMENT,
0921 SHIPS, SAFETY, PLATFORMS, PERSONNEL TRAINING, OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING, TANKERS,
0927 SHIPS, PRODUCT INFORMATION, POLLUTION PREVENTION, *LUBRICATION, *SEALING SYSTEMS,
1147 SHIPS, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, GUIDELINES, ECONOMICS,
R086 SHIPS, SEA SURFACE, POLLUTION CONTROL, OIL SLICKS, USN, *INTERFACE CHEMISTRY,
1016 SHORELINES, RECOVERY, MARINE ORGANISMS, DISPERSANTS, BEACH CLEANUP, *RECOLONIZATION, TORREY CANYON SPILL, UK,
1111 SHORELINES, OFFSHORE DRILLING, MARINE ORGANISMS, FATE, CONTAMINATION, BIOLOGICAL EFFECTS,
R112 SHORELINES, RESTORATION, MARSHES, ENVIRONMENTAL PROTECTION, *SURFACE TREATMENT AGENTS,
0802 SKIMMERS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, BOOMS, SPILL CLEANUP,
0805 SKIMMERS, PRODUCT INFORMATION, EQUIPMENT, *BRILL OIL SKIMMER,
0807 SKIMMERS, RIVERS, ICE, EQUIPMENT, CANADA, SPILL CLEANUP,
0811 SKIMMERS, PRODUCT INFORMATION, DESIGN-ENGINEERING, SPILL REMOVAL, USCG, *ZRV SKIMMER,
0852 SKIMMERS, PRODUCT INFORMATION, WASTEWATER TREATMENT,
0860 SKIMMERS, OIL TERMINALS, FLOTATION, WASTEWATER TREATMENT, *COAGULATION, USN,
R073 SKIMMERS, EVAPORATION, BOOMS, SPILL CLEANUP, SORBENTS, *FOAMS, *GELS,
0839 SLUDGE , PATENT, OIL-WATER SEPARATION, ABSORPTION,
0856 SLUDGE , EMULSIONS, WASTE OIL TREATMENT, SOIL, *COMPOSTING PROCESS,
0859 SLUDGE , PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION , WASTEWATER TREATMENT,
0868 SLUDGE , ADSORPTION, WASTEWATER TREATMENT, *SAND-OIL BINDER LAYER,
0904 SLUDGE , PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1077 SLUDGE , REFINERIES, INCINERATION, DISPOSAL , BIODEGRADATION, SOIL, *LAND FARMING,
R062 SLUDGE , REFINERIES, EPA, API, SOLID WASTES, TOXICITY, *TANK CLEANING, WATER QUALITY,
1042 SOCIAL EFFECTS, OIL INDUSTRY, NORTH CAROLINA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, *COASTAL PLAINS,
0732 SOIL, SEDIMENTS, MONITORING, FUEL OIL, DETECTION, *ELECTRICAL RESISTIVITY,
0856 SOIL, SLUDGE , EMULSIONS, WASTE OIL TREATMENT, *COMPOSTING PROCESS,
0992 SOIL, MICROORGANISMS, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, ARCTIC,
1002 SOIL, CHEMICAL ANALYSIS, TAR, *TRACE METALS,
1011 SOIL, RESTORATION, OIL SPILLS, SPILL REMOVAL,
1028 SOIL, SEAWATER, PETROLEUM PRODUCTS, HYDROCARBONS , CONTAMINATION, BEACHES, USSR,
1068 SOIL, DISPOSAL , BIODEGRADATION, BACTERIA, WASTE OIL, *BIODISPOSAL FARMING,
1077 SOIL, SLUDGE , REFINERIES, INCINERATION, DISPOSAL , BIODEGRADATION, *LAND FARMING,
1087 SOIL, CRUDE OIL, BIODEGRADATION, *(NH4)2SO4, *NUTRIENTS, *AERATION,
1086 SOIL, MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, YEASTS,
1089 SOIL, MICROORGANISMS, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA,
R126 SOIL, MONITORING, FATE, BIODEGRADATION, TOXICITY,
R134 SOIL, MICROORGANISMS, INLAND, CRUDE OIL, BIODEGRADATION, SUBARCTIC REGIONS,
0879 SOLID WASTES, REFINERIES, WASTEWATER TREATMENT,
0891 SOLID WASTES, PATENT, OIL-WATER SEPARATION, EQUIPMENT, *SLURRIES,
1159 SOLID WASTES, SAFETY, POLLUTION CONTROL, OCEANS, WASTEWATER TREATMENT, *REVIEW,
R060 SOLID WASTES, SAMPLING, OIL INDUSTRY, GROUNDWATER, CONTAMINATION, *LEACHING TEST,
R062 SOLID WASTES, SLUDGE , REFINERIES, EPA, API, TOXICITY, *TANK CLEANING, WATER QUALITY,
R080 SOLID WASTES, REGULATIONS, REFINERIES, DISPOSAL , WASTEWATER TREATMENT, *DATA BASE,
R066 SOLUBILITY, CRUDE OIL, CHEMICAL ANALYSIS, SPECTROMETRY, *MARKER COMPOUNDS, *SRM,
R139 SOLUBILITY, SEAWATER, HYDROCARBONS , CHEMICAL EFFECTS, USN,
1096 SOLUTION, OIL SLICKS, ICE, FRESHWATER, BEHAVIOR, SPILL CLEANUP,
0799 SOLVENTS, PATENT, ABSORPTION, SPILL REMOVAL, *POLYMERS,
0913 SOLVENTS, RECYCLING, RECLAMATION, LUBRICATING OIL,
0795 SORBENTS, PATENT, ADSORPTION, SPILL REMOVAL, SURFACTANTS,
0797 SORBENTS, PATENT, SPILL REMOVAL, *FOAM MATS,
0808 SORBENTS, PATENT, DESIGN-ENGINEERING, SPILL REMOVAL,
0809 SORBENTS, PATENT, ADSORPTION, SPILL CLEANUP, *ATTAPULGITE,
0870 SORBENTS, PETROLEUM PRODUCTS, WASTEWATER TREATMENT, *POLYURETHANE FOAM,
0884 SORBENTS, PATENT, OIL-WATER SEPARATION, ABSORPTION,
0895 SORBENTS, PATENT, OIL-WATER SEPARATION, *PLASTICS,
0905 SORBENTS, PATENT, OIL-WATER SEPARATION, ADSORPTION,

R073 SORBENTS, SKIMMERS, EVAPORATION, BOOMS, SPILL CLEANUP, *FOAMS, *GELS,
0753 SOURCE IDENTIFICATION, SEDIMENTS, HYDROCARBONS , GC/MS, BIOGENIC HYDROCARBONS,
0778 SOURCE IDENTIFICATION, PLATFORMS, OIL TRANSFER, OIL SPILLS, NORWAY, DETECTION, *LASER SYSTEM,
0779 SOURCE IDENTIFICATION, FUEL OIL, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
0780 SOURCE IDENTIFICATION, SEAWATER, OIL SPILLS, SOURCES, *ORGANIC MATTER,
0781 SOURCE IDENTIFICATION, SAMPLING, CRUDE OIL, CHROMATOGRAPHY, WEATHERING,
0782 SOURCE IDENTIFICATION, SAMPLING, SAFETY, MANUALS, CHEMICAL ANALYSIS, USCG, WEATHERING,
1105 SOURCE IDENTIFICATION, HYDROCARBONS , FUEL OIL, FATE, CHROMATOGRAPHY, CANADA, BIODEGRADATION, BAYS, *PENTACYCLIC TRITERPANES,
R087 SOURCE IDENTIFICATION, POLLUTION PREVENTION, OIL SPILLS, FATE, BEHAVIOR, SPILL CLEANUP, SURVEILLANCE,
0754 SOURCES, MONITORING, BIOLOGICAL EFFECTS, BIOASSAY, TOXICITY, *BIOLOGICAL TESTS,
0772 SOURCES, SEDIMENTS, NARRAGANSETT BAY, HYDROCARBONS , CHRONIC EFFECTS, BIOGENIC HYDROCARBONS, *RHODE ISLAND SOUND,
0780 SOURCES, SOURCE IDENTIFICATION, SEAWATER, OIL SPILLS, *ORGANIC MATTER,
0938 SOURCES, REGULATIONS, REFINERIES, POLLUTION CONTROL, OIL INDUSTRY,
0984 SOURCES, CARCINOGENS, BOOK REVIEW, BIOLOGICAL EFFECTS, TANKERS,
1022 SOURCES, RIVERS, CONTAMINANTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, WASTEWATERS,
1024 SOURCES, PACIFIC OCEAN, INTERTIDAL ZONE, BIOLOGICAL EFFECTS, SPILL CLEANUP,
1029 SOURCES, FATE, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS,
1033 SOURCES, PHYTOPLANKTON, OCEANS, CONTAMINATION, BIOLOGICAL EFFECTS, *RATE OF INPUT,
1034 SOURCES, OCEANS, LAKES , INDUSTRIES, BOOK REVIEW, WATER QUALITY,
1048 SOURCES, POLLUTION CONTROL, OIL INDUSTRY, OIL FIELDS, HEALTH HAZARDS, GROUNDWATER,
1104 SOURCES, RELEASE, PAH, MARINE ORGANISMS, HYDROCARBONS , FOOD WEB, BIODEGRADATION, UPTAKE,
1106 SOURCES, FATE, DISTRIBUTION, BIODEGRADATION, AROMATIC HYDROCARBONS,
1110 SOURCES, PAH, METABOLISM, HEALTH HAZARDS, DISTRIBUTION, CONTAMINANTS, CARCINOGENS,
1117 SOURCES, SEDIMENTS, PAH, ESTUARIES, CRUDE OIL, UK,
1118 SOURCES, MARINE ORGANISMS, HYDROCARBONS , CONTAMINANTS, UPTAKE,
R085 SOURCES, POLLUTION CONTROL, OIL DISCHARGES, CHEMICAL EFFECTS, *MILITARY INSTALLATIONS,
0749 SPECTROMETRY, PAH, DISTILLATION, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES,
0751 SPECTROMETRY, MARINE ORGANISMS, HYDROCARBONS , CHROMATOGRAPHY, CHEMICAL ANALYSIS,
0765 SPECTROMETRY, PETROLEUM PRODUCTS, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *GRAVIMETRY,
0769 SPECTROMETRY, SEDIMENTS, MARSHES, FUEL OIL, CHROMATOGRAPHY, BUZZARDS BAY, AROMATIC HYDROCARBONS,
0775 SPECTROMETRY, EXTRACTION, CHEMICAL ANALYSIS, WASTEWATERS,
R066 SPECTROMETRY, SOLUBILITY, CRUDE OIL, CHEMICAL ANALYSIS, *MARKER COMPOUNDS, *SRM,
0746 SPECTROSCOPY, SEAWATER, HYDROCARBONS ,
1060 SPECTROSCOPY, SEAWATER, SAMPLING, GULF OF MEXICO, DEEPWATER PORTS, BASELINE STUDIES, AROMATIC HYDROCARBONS,
0784 SPILL CLEANUP, DISPERSANTS, BIODEGRADATION, *COMBUSTION, *COASTAL WATERS,
0786 SPILL CLEANUP, PATENT, DISPERSANTS,
0787 SPILL CLEANUP, ADSORPTION, *PEAT AND FIBERS, *REVIEW,
0789 SPILL CLEANUP, FUEL OIL, ABSORPTION, *DIESEL OIL, *POLYURETHANE FOAM,
0793 SPILL CLEANUP, PATENT, EMULSIONS, ADSORPTION, *EXPANDED PYROPHYLLITE,
0796 SPILL CLEANUP, PATENT, ADSORPTION, *SORBENT KAPOK FIBERS,
0800 SPILL CLEANUP, MONITORING, FATE, EQUIPMENT, ARGO MERCHANT SPILL, *ACCIDENT RESPONSE,
0801 SPILL CLEANUP, EQUIPMENT, ARCTIC, SPILL REMOVAL, *AMOP,
0802 SPILL CLEANUP, SKIMMERS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, BOOMS,
0803 SPILL CLEANUP, EMULSIONS, DISPERSANTS, BALTIC SEA, SURFACTANTS, TANKERS,
0807 SPILL CLEANUP, SKIMMERS, RIVERS, ICE, EQUIPMENT, CANADA,
0809 SPILL CLEANUP, SORBENTS, PATENT, ADSORPTION, *ATTAPULGITE,
0816 SPILL CLEANUP, PETROLEUM PRODUCTS, PATENT, DISPERSANTS,
0817 SPILL CLEANUP, ICE, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
0818 SPILL CLEANUP, PATENT, *AGENT,
0923 SPILL CLEANUP, LEGISLATION, GOVERNMENT AGENCIES, CONTINGENCY PLANNING, CANADA, *ONTARIO,
0933 SPILL CLEANUP, POLLUTION CONTROL, EQUIPMENT, DISPERSANTS, CANADA, *DISPERSANT TECHNOLOGY,
0939 SPILL CLEANUP, POLLUTION PREVENTION, PETROLEUM PRODUCTS,
1021 SPILL CLEANUP, HABITATS, ENVIRONMENTAL EFFECTS, COASTS, COASTAL ZONE MANAGEMENT, BIOLOGICAL EFFECTS,
1024 SPILL CLEANUP, SOURCES, PACIFIC OCEAN, INTERTIDAL ZONE, BIOLOGICAL EFFECTS,
1086 SPILL CLEANUP, BIODEGRADATION, BACTERIA,
1096 SPILL CLEANUP, SOLUTION, OIL SLICKS, ICE, FRESHWATER, BEHAVIOR,
1114 SPILL CLEANUP, NORTH SEA, FATE, BEHAVIOR, ARGO MERCHANT SPILL,
1144 SPILL CLEANUP, COMPENSATION, AMOCO CADIZ SPILL, *CRISTAL,
R071 SPILL CLEANUP, FATE, DISPERSIONS, DISPERSANTS,
R072 SPILL CLEANUP, FATE, DISPERSIONS, DISPERSANTS,
R073 SPILL CLEANUP, SORBENTS, SKIMMERS, EVAPORATION, BOOMS, *FOAMS, *GELS,
R074 SPILL CLEANUP, SAMPLING, EQUIPMENT, DISPERSANTS, *APPLICATION,
R087 SPILL CLEANUP, SOURCE IDENTIFICATION, POLLUTION PREVENTION, OIL SPILLS, FATE, BEHAVIOR, SURVEILLANCE,

R136 SPILL CLEANUP, BIODEGRADATION, SURFACTANTS, WASTEWATER TREATMENT, *SOLUBILIZATION,
R138 SPILL CLEANUP, OIL SLICKS, MODELS, FATE, SPREADING,
0783 SPILL CONTAINMENT, PRODUCT INFORMATION, BOOMS, *VATOR OY CO,
0806 SPILL CONTAINMENT, SHIPS, PATENT, EQUIPMENT, BOOMS, SPILL REMOVAL,
0817 SPILL CONTAINMENT, SPILL CLEANUP, ICE, DESIGN-ENGINEERING, BOOMS,
1170 SPILL CONTAINMENT, OIL SLICKS, BEHAVIOR, *PLUME,
0792 SPILL DISPOSAL, INCINERATION, EQUIPMENT, CANADA,
0785 SPILL REMOVAL, ICE, HARBORS, EQUIPMENT, BLACK SEA,
0788 SPILL REMOVAL, ABSORPTION, *FOAM, * POLYURETHANE,
0790 SPILL REMOVAL, PATENT, ADSORPTION, *PERLITE,
0791 SPILL REMOVAL, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, TORREY CANYON SPILL, UK,
0794 SPILL REMOVAL, SEA SURFACE, PATENT, BEACH CLEANUP, ABSORPTION,
0795 SPILL REMOVAL, SORBENTS, PATENT, ADSORPTION, SURFACTANTS,
0797 SPILL REMOVAL, SORBENTS, PATENT, *FOAM MATS,
0798 SPILL REMOVAL, SEDIMENTS, PATENT, BEACH CLEANUP,
0799 SPILL REMOVAL, SOLVENTS, PATENT, ABSORPTION, *POLYMERS,
0801 SPILL REMOVAL, SPILL CLEANUP, EQUIPMENT, ARCTIC, *AMOP,
0804 SPILL REMOVAL, PATENT, ADSORPTION, *SHAPED PITCH,
0806 SPILL REMOVAL, SPILL CONTAINMENT, SHIPS, PATENT, EQUIPMENT, BOOMS,
0808 SPILL REMOVAL, SORBENTS, PATENT, DESIGN-ENGINEERING,
0810 SPILL REMOVAL, PATENT, ABSORPTION,
0811 SPILL REMOVAL, SKIMMERS, PRODUCT INFORMATION, DESIGN-ENGINEERING, USCG, *ZRV SKIMMER,
0812 SPILL REMOVAL, PATENT, EMULSIFICATION, DECOMPOSITION, CRUDE OIL, YEAST, *RICE BRAN,
0814 SPILL REMOVAL, PATENT, ABSORBENTS, *POLYURETHANE RESIN FOAM,
0815 SPILL REMOVAL, PATENT, DISTILLATION, ABSORPTION, *CEMENT,
0819 SPILL REMOVAL, PATENT, ABSORPTION, *FIBER MATERIAL,
0886 SPILL REMOVAL, PRODUCT INFORMATION, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, *ENQUIP INC,
0900 SPILL REMOVAL, PRODUCT INFORMATION, OIL-WATER SEPARATION, *OIL RECOVERY SYSTEMS INC,
0925 SPILL REMOVAL, PRODUCT INFORMATION, POLLUTION PREVENTION, MONITORING, BILGES, BALLAST
1011 SPILL REMOVAL, SOIL, RESTORATION, OIL SPILLS,
1032 SPILL REMOVAL, FRANCE, COASTS, BIOLOGICAL EFFECTS, BEACH CLEANUP, AMOCO CADIZ SPILL,
R075 SPILL REMOVAL, SEDIMENTS, GASOLINE, SURFACTANTS, *UNDERGROUND RECOVERY ,
R076 SPILL REMOVAL, SAFETY, POLLUTION PREVENTION, MANUALS, ENVIRONMENTAL PROTECTION, DISPERSANTS, BIRDS,
R110 SPILL REMOVAL, SEDIMENTATION, DISPERSIONS, COASTS, BEHAVIOR, BEACH CLEANUP, AMOCO CADIZ SPILL,
0738 SPREADING, REMOTE SENSING, MODELS, DRIFT, DELAWARE BAY, *DENSITY FRONTS, *SATELLITES, *LANDSAT,
1099 SPREADING, OIL SLICKS, MOVEMENT, LAKES , EVAPORATION, CRUDE OIL,
1122 SPREADING, OIL SPILLS, MODELS, EKOFISK BLOWOUT, BEHAVIOR, *OILSIM,
R138 SPREADING, SPILL CLEANUP, OIL SLICKS, MODELS, FATE,
1125 STATE GOVERNMENTS, RESOURCE MANAGEMENT, COASTAL ZONE MANAGEMENT, API,
1128 STATE GOVERNMENTS, REGULATIONS, PORTS , OCS, LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT, TANKERS,
0720 STATISTICAL ANALYSIS, ARGO MERCHANT SPILL, TANKERS,
0990 STATISTICAL ANALYSIS, SEDIMENTS, MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA SPILL, BUZZARDS BAY, BENTHOS,
1015 STATISTICAL ANALYSIS, RECOVERY, FUEL OIL, CONTAMINATION, ANTARCTICA,
R147 STATISTICAL ANALYSIS, POLLUTION CONTROL, OIL INDUSTRY, EPA, API, WATER QUALITY,
R149 STATISTICAL ANALYSIS, REFINERIES, MODELS, GUIDELINES, EPA, COST ANALYSIS, API, WASTEWATERS,
0715 STATISTICS, SCOTLAND, OIL TERMINALS, NORTH SEA, BIRDS,
0717 STATISTICS, PIPELINES, PETROLEUM PRODUCTS, OIL SPILLS, OIL INDUSTRY, EUROPE,
0718 STATISTICS, PETROLEUM PRODUCTS, OIL SPILLS, CANADA, *NATES DATABASE,
0721 STATISTICS, OIL SPILLS, USCG, *NEW ENGLAND , *REVIEW,
0723 STATISTICS, IRELAND, COASTS,
0724 STATISTICS, OIL SPILLS, TANKERS,
0825 STATISTICS, REFINERIES, EUROPE, WASTEWATER TREATMENT, WATER QUALITY,
0920 STATISTICS, PERSONNEL TRAINING, OIL SPILLS, MANUALS, API,
1065 STATISTICS, SAFETY, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, ALASKA, *HAZARDS,
1162 STATISTICS, PETROLEUM PRODUCTS, INDUSTRIES, GASOLINE, TOXICITY, *TOXICOLOGICAL LABORATORY,
1058 STORAGE, LOUISIANA, FEA, EIS, CRUDE OIL, *SALT DOME, *STRATEGIC PETROLEUM RESERVE,
R084 STORAGE, RECLAMATION, OIL-WATER SEPARATION, OIL TANKS, DESIGN-ENGINEERING, USN, *TANK CLEANING,
1071 STRAIT OF MAGELLAN, MICROORGANISMS, METULA SPILL, BIODEGRADATION, BACTERIA, WEATHERING,
R109 SUBARCTIC REGIONS, NOAA, MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES, TOXICITY,
R134 SUBARCTIC REGIONS, SOIL, MICROORGANISMS, INLAND, CRUDE OIL, BIODEGRADATION,
0773 SUBLETHAL EFFECTS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, ACUTE EFFECTS, TOXICITY,
0945 SUBLETHAL EFFECTS, GASOLINE, WSF, UPTAKE, *INSECTS, *OXYGEN CONSUMPTION, *AEDES AEGYPTI,

0953 SUBLETHAL EFFECTS, MORTALITY, MOLLUSKS, HYDROCARBONS , CRUDE OIL, BACTERIA, TOXICITY, WSF, WASTE OIL,
0969 SUBLETHAL EFFECTS, GROWTH, CRUDE OIL, BEHAVIOR, WSF, *FEEDING RATES, *MERCENARIA MERCENARIA,
0974 SUBLETHAL EFFECTS, FUEL OIL, BEHAVIOR, WSF, ZOOPLANKTON, *LUCIFER FAXONI,
0981 SUBLETHAL EFFECTS, FISH, CRUDE OIL, CHRONIC EFFECTS, *TISSUES, *TAUTOGOLABRUS ADSPERSUS,
0988 SUBLETHAL EFFECTS, REPRODUCTION, POLYCHAETES, GROWTH, FUEL OIL, WSF, *NEANTHES ARENACEODENTATA,
0995 SUBLETHAL EFFECTS, RELEASE, MOLLUSKS, HYDROCARBONS , FUEL OIL, UPTAKE, *RESPIRATION RATES, *MYA ARENARIA,
1001 SUBLETHAL EFFECTS, HYDROCARBONS , CONTAMINATION,
1039 SUBLETHAL EFFECTS, MICROORGANISMS, MARSHES, MARINE ORGANISMS, ESTUARIES, BIODEGRADATION, *PROCEEDINGS,
1160 SUBLETHAL EFFECTS, CONTAMINATION, BIOINDICATORS, *TELEMEDIATORS,
R092 SUBLETHAL EFFECTS, METABOLISM, HYDROCARBONS , FISH, *TEMPERATURE,
R093 SUBLETHAL EFFECTS, METABOLISM, HYDROCARBONS , FISH, *TEMPERATURE,
R099 SUBLETHAL EFFECTS, SEAWATER, CRUDE OIL, CONTAMINANTS, BACTERIA, MICROORGANISMS, *CHEMOTAXIS,
R106 SUBLETHAL EFFECTS, GUIDELINES, BIRDS, TOXICITY,
0760 SURFACTANTS, EXTRACTION, DETECTION, CHEMICAL ANALYSIS, WASTEWATERS, *MEASUREMENT ERROR,
0795 SURFACTANTS, SPILL REMOVAL, SORBENTS, PATENT, ADSORPTION,
0803 SURFACTANTS, SPILL CLEANUP, EMULSIONS, DISPERSANTS, BALTIC SEA, TANKERS,
0846 SURFACTANTS, PATENT, WASTEWATER TREATMENT, *ELECTROLYSIS,
1121 SURFACTANTS, SEAWATER, PETROLEUM PRODUCTS, OXIDATION, MODELS, *PHENOLS, *O2 REGIMES,
R075 SURFACTANTS, SPILL REMOVAL, SEDIMENTS, GASOLINE, *UNDERGROUND RECOVERY ,
R136 SURFACTANTS, SPILL CLEANUP, BIODEGRADATION, WASTEWATER TREATMENT, *SOLUBILIZATION,
0736 SURVEILLANCE, REMOTE SENSING, MONITORING, LEGISLATION, EUROPE, *SATELLITES,
R077 SURVEILLANCE, SAFETY, POLLUTION CONTROL, LEAKAGE, EQUIPMENT, DESIGN-ENGINEERING, *REMOTE CONTROL HOVERCRAFT,
R087 SURVEILLANCE, SPILL CLEANUP, SOURCE IDENTIFICATION, POLLUTION PREVENTION, OIL SPILLS, FATE, BEHAVIOR,
0719 TANKERS, OIL TERMINALS OIL SPILLS, OIL SLICKS, MORTALITY, BIRDS, *MILFORD HAVEN,
0720 TANKERS, STATISTICAL ANALYSIS, ARGO MERCHANT SPILL,
0724 TANKERS, STATISTICS, OIL SPILLS,
0725 TANKERS, OIL SPILLS, STATISITCS,
0803 TANKERS, SURFACTANTS, SPILL CLEANUP, EMULSIONS, DISPERSANTS, BALTIC SEA,
0820 TANKERS, SAFETY, POLLUTION PREVENTION, *DOUBLE BOTTOMS,
0821 TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, IMCO, CRUDE OIL WASHING, *LOAD-ON-TOP,
0822 TANKERS, RESOURCE MANAGEMENT, REGULATIONS, OCEANS, IMCO, TORREY CANYON SPILL,
0823 TANKERS, SAFETY, POLLUTION PREVENTION, EQUIPMENT, DESIGN-ENGINEERING, *DESTATOR DEVICE,
0824 TANKERS, SEGREGATED BALLAST, SAFETY, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, AMOCO CADIZ SPILL,
0854 TANKERS, INDUSTRIES, BALLAST , WASTEWATER TREATMENT, *REVIEW,
0863 TANKERS, OIL TERMINALS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, USN, VIRGINIA,
0899 TANKERS, PATENT, OIL-WATER SEPARATION, OIL TANKS, WASTE OIL, *WASTE CLAY,
0921 TANKERS, SHIPS, SAFETY, PLATFORMS, PERSONNEL TRAINING, OIL TRANSPORT, MANUALS, DESIGN-ENGINEERING,
0922 TANKERS, SAFETY, OIL SPILLS, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING,
0934 TANKERS, SAFETY, POLLUTION PREVENTION, *STATIC ELECTRICITY,
0984 TANKERS, SOURCES, CARCINOGENS, BOOK REVIEW, BIOLOGICAL EFFECTS,
1035 TANKERS, OIL SPILLS, OCEANS, DRILLING ,
1047 TANKERS, PORTS , OIL TERMINALS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, UK, *OCEAN MANAGEMENT, *PROCEEDINGS,
1059 TANKERS, OIL SPILLS, ENVIRONMENTAL PROTECTION, DEEPWATER PORTS, BAHAMAS,
1126 TANKERS, REGULATIONS, POLLUTION PREVENTION, LEGISLATION, IMCO, US,
1128 TANKERS, STATE GOVERNMENTS, REGULATIONS, PORTS , OCS, LEGISLATION, GOVERNMENT AGENCIES, COASTAL ZONE MANAGEMENT,
1134 TANKERS, LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, US, *LAW OF THE SEA,
1135 TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO,
1141 TANKERS, SAFETY, OIL SPILLS, ENVIRONMENTAL PROTECTION, AMOCO CADIZ SPILL, *NEGOTIATIONS,
1145 TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION, IMCO, CRUDE OIL WASHING,
1146 TANKERS, SEGREGATED BALLAST, SAFETY, INTERNATIONAL AGREEMENTS, IMCO, CRUDE OIL WASHING, AMOCO CADIZ SPILL,
1148 TANKERS, POLLUTION PREVENTION, IMCO, GUIDELINES, ECONOMICS, DESIGN-ENGINEERING,
1149 TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO, CRUDE OIL WASHING,
1154 TANKERS, PORTS , OIL SPILLS, ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, *SUPERTANKERS,
1155 TANKERS, PORTS , ENVIRONMENTAL EFFECTS, DEEPWATER PORTS, BIBLIOGRAPHIES, *SUPERTANKERS,
1002 TAR, SOIL, CHEMICAL ANALYSIS, *TRACE METALS,
1080 TAR, MICROORGANISMS, HYDROCARBONS , DISPERSANTS, CRUDE OIL, BIODEGRADATION,
1103 TAR, SAMPLING, DISTRIBUTION, BEACHES, BAHAMAS,

1120 TAR, SEAWATER, MODELS, FATE, *PETROLEUM PARTICLES,
0791 TORREY CANYON SPILL, SPILL REMOVAL, ENVIRONMENTAL EFFECTS, DISPERSANTS, TOXICITY, UK,
0822 TORREY CANYON SPILL, TANKERS, RESOURCE MANAGEMENT, REGULATIONS, OCEANS, IMCO,
1003 TORREY CANYON SPILL, RECOVERY, CONTAMINATION, BIRDS, AMOCO CADIZ SPILL,
1007 TORREY CANYON SPILL, RESTORATION, OIL SPILLS, CONSERVATION, BIRDS,
1016 TORREY CANYON SPILL, SHORELINES, RECOVERY, MARINE ORGANISMS, DISPERSANTS, BEACH CLEANUP, *RECOLONIZATION, UK,
0754 TOXICITY, SOURCES, MONITORING, BIOLOGICAL EFFECTS, BIOASSAY, *BIOLOGICAL TESTS,
0773 TOXICITY, SUBLETHAL EFFECTS, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, ACUTE EFFECTS,
0774 TOXICITY, PHYTOPLANKTON, GROWTH, FUEL OIL, CHEMICAL ANALYSIS, ALGAE, WSF,
0791 TOXICITY, TORREY CANYON SPILL, SPILL REMOVAL, ENVIRONMENTAL EFFECTS, DISPERSANTS, UK,
0853 TOXICITY, INDUSTRIES, GOVERNMENT AGENCIES, DISPOSAL , WASTE OIL,
0944 TOXICITY, CRUDE OIL, BIOASSAY, AROMATIC HYDROCARBONS, ACUTE EFFECTS, *MORONE SAXATILIS, *CRANGON FRANCISCORUM,
0950 TOXICITY, CHEMICAL EFFECTS, CHEMICAL ANALYSIS, BACTERIA, ALGAE, *TGK VALUES,
0951 TOXICITY, MARINE ORGANISMS, *INNOCUOUS OIL LEVEL, *REVIEW,
0952 TOXICITY, OIL SPILLS, HYDROCARBONS , ARCTIC, AMPHIPODS,
0953 TOXICITY, SUBLETHAL EFFECTS, MORTALITY, MOLLUSKS, HYDROCARBONS , CRUDE OIL, BACTERIA, WSF, WASTE OIL,
0958 TOXICITY, AROMATIC HYDROCARBONS, *MUTAGENICITY, *BIOTRANSFORMATIONS, *REVIEW,
0959 TOXICITY, MORTALITY, FUEL OIL, CRUSTACEANS, CRUDE OIL, WSF, *LARVAE,
0961 TOXICITY, DISPERSANTS, BIOLOGICAL EFFECTS, ALGAE, *CELL MEMBRANES, *NITELLA FLEXILIS,
0962 TOXICITY, REPRODUCTION, FUEL OIL, WSF, COPEPODS, *TIGRIOPUS JAPONICUS,
0976 TOXICITY, HYDROCARBONS , GROWTH, BIOLOGICAL EFFECTS, *MUSSELS,
0978 TOXICITY, SEDIMENTS, FISH, CRUDE OIL, BIOLOGICAL EFFECTS, UPTAKE, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0979 TOXICITY, FUEL OIL, CRUSTACEANS, AMPHIPODS, *EXPERIMENTAL VARIABLES, *NEOHAUSTORIUS SCHMITZI,
0991 TOXICITY, MORTALITY, DISPERSANTS, CRUSTACEANS, CRUDE OIL, ARCTIC, ACUTE EFFECTS, *COREXIT 9527,
0994 TOXICITY, RELEASE, MOLLUSKS, BEHAVIOR, FUEL OIL, UPTAKE, *RESPIRATION, *MYA ARENARIA,
0999 TOXICITY, SEAWATER, PHYTOPLANKTON, DISPERSANTS, CRUDE OIL, *CARBON FIXATION, *COREXIT 9527,
1023 TOXICITY, AROMATIC HYDROCARBONS, *ALIPHATIC HYDROCARBONS, *REVIEW,
1076 TOXICITY, MARINE ORGANISMS, FOOD WEB, BIODEGRADATION, ACTIVATED SLUDGE, WASTEWATERS, YEASTS,
1127 TOXICITY, POLLUTION CONTROL, LEGISLATION, *FEDERAL WATER POLLUTION CONTROL ACT,
1156 TOXICITY, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, *INFORMATION SOURCES ,
1162 TOXICITY, STATISTICS, PETROLEUM PRODUCTS, INDUSTRIES, GASOLINE, *TOXICOLOGICAL LABORATORY,
1169 TOXICITY, FISH, CONTAMINANTS, BEHAVIOR, ANALYTICAL TECHNIQUES,
1172 TOXICITY, REFINERIES, BIOASSAY, WATER QUALITY, WASTEWATERS, *DAPHNIA,
R062 TOXICITY, SOLID WASTES, SLUDGE , REFINERIES, EPA, API, *TANK CLEANING, WATER QUALITY,
R064 TOXICITY, SAMPLING, REFINERIES, CONTAMINANTS, ANALYTICAL TECHNIQUES, WASTEWATERS,
R065 TOXICITY, REFINERIES, INVERTEBRATES, INTERTIDAL ZONE, FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES, WASTEWATERS,
R081 TOXICITY, PAH, HEALTH HAZARDS, CONTAMINANTS, ANIMALS, WASTEWATERS,
R088 TOXICITY, MARINE ORGANISMS, DISPERSANTS, BIOLOGICAL EFFECTS, BIOASSAY,
R089 TOXICITY, PHYTOPLANKTON, MONITORING, BALLAST , ALASKA,
R091 TOXICITY, MARINE ORGANISMS, HEALTH HAZARDS, CARCINOGENS, AROMATIC HYDROCARBONS, *PNA,
R106 TOXICITY, SUBLETHAL EFFECTS, GUIDELINES, BIRDS,
R109 TOXICITY, SUBARCTIC REGIONS, NOAA, MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, ANALYTICAL TECHNIQUES,
R116 TOXICITY, MARINE ORGANISMS, GULF OF MEXICO, BIOASSAY, *DRILLING MUDS,
R126 TOXICITY, SOIL, MONITORING, FATE, BIODEGRADATION,
R128 TOXICITY, GROWTH, FUNGI, EMULSIFICATION, BIODEGRADATION, YEASTS,
0727 UK, REFINERIES, OIL TERMINALS, MONITORING, ENVIRONMENTAL DETERIORATION,
0791 UK, TOXICITY, TORREY CANYON SPILL, SPILL REMOVAL, ENVIRONMENTAL EFFECTS, DISPERSANTS,
0940 UK, OIL SLICKS, MORTALITY, BIRDS,
0957 UK, BIRDS, BIOLOGICAL EFFECTS, *SHETLAND ISLANDS,
1016 UK, TORREY CANYON SPILL, SHORELINES, RECOVERY, MARINE ORGANISMS, DISPERSANTS, BEACH CLEANUP, *RECOLONIZATION,
1047 UK, TANKERS, PORTS , OIL TERMINALS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, *OCEAN MANAGEMENT, *PROCEEDINGS,
1117 UK, SOURCES, SEDIMENTS, PAH, ESTUARIES, CRUDE OIL,
1136 UK, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, LEGISLATION,
0841 ULTRAFILTRATION, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *MEMBRANES,
0866 ULTRAFILTRATION, OIL-WATER SEPARATION, INDUSTRIES, WASTEWATER TREATMENT, *POROUS GLASS MEMBRANE,
0729 UPTAKE, PATENT, MONITORING, CHEMICAL ANALYSIS, *FLUOROMETRY,
0748 UPTAKE, PHYTOPLANKTON, HYDROCARBONS , GROWTH, BIOASSAY, *EXPERIMENTAL DESIGN, *BENZENE,
0945 UPTAKE, SUBLETHAL EFFECTS, GASOLINE, WSF, *INSECTS, *OXYGEN CONSUMPTION, *AEDES AEGYPTI,
0948 UPTAKE, RIVERS, RELEASE, MOLLUSKS, HYDROCARBONS , CHRONIC EFFECTS, *MERCENARIA MERCENARIA,

0954 UPTAKE, INTERTIDAL ZONE, ECHINODERMS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, WEATHERING, *GENERAL M.C. MEIGS SPILL,
0965 UPTAKE, MOLLUSKS, GROWTH, FUEL OIL, CHRONIC EFFECTS, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, *CARBON FLUX, *MYA ARENARIA,
0978 UPTAKE, TOXICITY, SEDIMENTS, FISH, CRUDE OIL, BIOLOGICAL EFFECTS, *BIOAVAILABILITY, *POROPHRYS VETULUS,
0986 UPTAKE, SEDIMENTS, PRUDHOE BAY, PAH, INVERTEBRATES, HYDROCARBONS , CRUDE OIL,
0987 UPTAKE, SEDIMENTS, PRUDHOE BAY, MOLLUSKS, CRUDE OIL, *NAPHTHALENES, *MACOMA INQUINATA,
0993 UPTAKE, MEDITERRANEAN SEA, INVERTEBRATES, HYDROCARBONS , BIOINDICATORS, *MYTILUS GALLOPROVINCIALIS,
0994 UPTAKE, TOXICITY, RELEASE, MOLLUSKS, BEHAVIOR, FUEL OIL, *RESPIRATION, *MYA ARENARIA,
0995 UPTAKE, SUBLETHAL EFFECTS, RELEASE, MOLLUSKS, HYDROCARBONS , FUEL OIL, *RESPIRATION RATES, *MYA ARENARIA,
1027 UPTAKE, SEDIMENTS, MOLLUSKS, CRUDE OIL, ADSORPTION, ABSORPTION, *OYSTERS,
1040 UPTAKE, METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FATE, ECOSYSTEMS, BIOLOGICAL EFFECTS, *PROCEEDINGS,
1104 UPTAKE, SOURCES, RELEASE, PAH, MARINE ORGANISMS, HYDROCARBONS , FOOD WEB, BIODEGRADATION,
1118 UPTAKE, SOURCES, MARINE ORGANISMS, HYDROCARBONS , CONTAMINANTS,
1165 UPTAKE, MOLLUSKS, BIOASSAY, BIOINDICATORS, *MERCURY, *FIELD TECHNIQUE,
R067 UPTAKE, SEDIMENTS, OXIDATION, HYDROCARBONS , DELAWARE, CRANKCASE OIL, CONTAMINANTS, CHEMICAL ANALYSIS, *CHARACTERIZATION,
R101 UPTAKE, SEDIMENTATION, RELEASE, HYDROCARBONS , GROWTH, FOOD WEB, CORAL REEFS, *DRILLING MUD,
R130 UPTAKE, NEW JERSEY, MICROORGANISMS, FOOD WEB, ESTUARIES, CONTAMINANTS, BIOLOGICAL EFFECTS, BIODEGRADATION,
0917 US, RESOURCE MANAGEMENT, RECYCLING, LUBRICATING OIL, LEGISLATION, GOVERNMENT AGENCIES, WASTE OIL,
0932 US, REFINING, POLLUTION CONTROL, LEGISLATION, WASTEWATER TREATMENT,
1050 US, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DEVELOPMENT , DEEPWATER PORTS,
1126 US, TANKERS, REGULATIONS, POLLUTION PREVENTION, LEGISLATION, IMCC,
1129 US, OIL SPILLS, OIL DISCHARGES, LIABILITY, LEGISLATION, *WATER POLLUTION CONTROL ACT,
1130 US, POLLUTION CONTROL, LIABILITY, LEGISLATION, *CLEAN WATER ACT 1977,
1134 US, TANKERS, LAW ENFORCEMENT, INTERNATIONAL AGREEMENTS, *LAW OF THE SEA,
1150 US, POLLUTION PREVENTION, LIABILITY, INTERNATIONAL CONVENTIONS, INTERNATIONAL AGREEMENTS, CONTINGENCY PLANNING, COMPENSATION,
0721 USCG, STATISTICS, OIL SPILLS, *NEW ENGLAND , *REVIEW,
0782 USCG, SOURCE IDENTIFICATION, SAMPLING, SAFETY, MANUALS, CHEMICAL ANALYSIS, WEATHERING,
0811 USCG, SPILL REMOVAL, SKIMMERS, PRODUCT INFORMATION, DESIGN-ENGINEERING, *ZRV SKIMMER,
0860 USN, SKIMMERS, OIL TERMINALS, FLOTATION, WASTEWATER TREATMENT, *COAGULATION,
0863 USN, TANKERS, OIL TERMINALS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL, VIRGINIA,
R069 USN, HYDROCARBONS , DETECTION, ANALYTICAL TECHNIQUES, *OIL/GREASE IN WATER,
R084 USN, STORAGE, RECLAMATION, OIL-WATER SEPARATION, OIL TANKS, DESIGN-ENGINEERING, *TANK CLEANING,
R086 USN, SHIPS, SEA SURFACE, POLLUTION CONTROL, OIL SLICKS, *INTERFACE CHEMISTRY,
R139 USN, SOLUBILITY, SEAWATER, HYDROCARBONS , CHEMICAL EFFECTS,
0936 USSR, RIVERS, POLLUTION CONTROL, PETROLEUM PRODUCTS, WASTEWATERS, *URAL RIVER,
1028 USSR, SOIL, SEAWATER, PETROLEUM PRODUCTS, HYDROCARBONS , CONTAMINATION, BEACHES,
0943 VERTEBRATES , METABOLISM, MARINE ORGANISMS, INVERTEBRATES, CONTAMINANTS, *BIOTRANSFORMATIONS,
0863 VIRGINIA, USN, TANKERS, OIL TERMINALS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, WASTE OIL,
0837 WASTE OIL, RECYCLING, INDUSTRIES, DISPOSAL ,
0850 WASTE OIL, PATENT, INCINERATION, ABSORPTION, *ATOMIZATION, WASTEWATER,
0851 WASTE OIL, INCINERATION, FUEL OIL, DISPOSAL , *STACK EMISSIONS,
0853 WASTE OIL, TOXICITY, INDUSTRIES, GOVERNMENT AGENCIES, DISPOSAL ,
0862 WASTE OIL, WASTEWATER TREATMENT, WATER QUALITY, *MUNICIPAL SEWAGE,
0863 WASTE OIL, VIRGINIA, USN, TANKERS, OIL TERMINALS, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
0872 WASTE OIL, REFINING, RECLAMATION, LUBRICATING OIL, DISPOSAL , CARCINOGENS, AROMATIC HYDROCARBONS,
0899 WASTE OIL, TANKERS, PATENT, OIL-WATER SEPARATION, OIL TANKS, *WASTE CLAY,
0910 WASTE OIL, RECYCLING, RECLAMATION, POLLUTION CONTROL,
0911 WASTE OIL, RESOURCE MANAGEMENT, LEGISLATION, ILLINOIS, *PROCEEDINGS,
0912 WASTE OIL, REUSE, RECYCLING, LEGISLATION, INDUSTRIES, CRANKCASE OIL, *PROCEEDINGS,
0914 WASTE OIL, REFINING, RECYCLING, OIL INDUSTRY, ENVIRONMENTAL MANAGEMENT, ECONOMICS, DISPOSAL ,
0915 WASTE OIL, RECYCLING, INDUSTRIES, GOVERNMENT AGENCIES,
0917 WASTE OIL, US, RESOURCE MANAGEMENT, RECYCLING, LUBRICATING OIL, LEGISLATION, GOVERNMENT AGENCIES,
0918 WASTE OIL, REFINING, RECLAMATION, PATENT,
0953 WASTE OIL, TOXICITY, SUBLETHAL EFFECTS, MORTALITY, MOLLUSKS, HYDROCARBONS , CRUDE OIL, BACTERIA, WSF,

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1036 WASTE OIL, PETROLEUM PRODUCTS, HEALTH HAZARDS, DISPOSAL , CRUDE OIL, CONTAMINANTS, *TRACE METALS, *ASPHALT,
1041 WASTE OIL, PETROLEUM PRODUCTS, HEALTH HAZARDS, ENVIRONMENTAL EFFECTS, CRUDE OIL, CONTAMINANTS, *TRACE METALS,
1066 WASTE OIL, SOIL, DISPOSAL , BIODEGRADATION, BACTERIA, *BIODISPOSAL FARMING,
0830 WASTE OIL TREATMENT, REFINING, INDUSTRIES, EQUIPMENT, EMULSIONS, ECONOMICS, *TECHNOLOGY REVIEW,
0856 WASTE OIL TREATMENT, SOIL, SLUDGE , EMULSIONS, *COMPOSTING PROCESS,
0874 WASTE OIL TREATMENT, PATENT, OIL-WATER SEPARATION, LUBRICATING OIL, *OIL REMOVAL,
0916 WASTE OIL TREATMENT, REUSE, PATENT, *SOLID FUEL,
0919 WASTE OIL TREATMENT, RECLAMATION, PATENT, EXTRACTION. CRANKCASE OIL,
0713 WASTEWATERS, REFINERIES, PIPELINES, LEAKAGE, *CONCAWE,
0734 WASTEWATERS, SHIPS, POLLUTION PREVENTION, OIL-WATER SEPARATION, MONITORING, INCINERATION, BALLAST ,
0744 WASTEWATERS, SAMPLING, MONITORING, EQUIPMENT, WATER QUALITY,
0759 WASTEWATERS, DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, *SPECTROFLUOROMETRY,
0760 WASTEWATERS, SURFACTANTS, EXTRACTION, DETECTION, CHEMICAL ANALYSIS, *MEASUREMENT ERROR,
0761 WASTEWATERS, PETROLEUM PRODUCTS, GROUNDWATER, ANALYTICAL TECHNIQUES,
0766 WASTEWATERS, ANALYTICAL TECHNIQUES, *DUAL-WAVELENGTH SPECTROPHOTOMETRY, *DISPERSED OIL,
0767 WASTEWATERS, PETROLEUM PRODUCTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
0775 WASTEWATERS, SPECTROMETRY, EXTRACTION, CHEMICAL ANALYSIS,
0826 WASTEWATERS, OIL-WATER SEPARATION, INDUSTRIES, ADSORPTION, *AGENT NT75,
0843 WASTEWATERS, REGULATIONS, REFINERIES, POLLUTION PREVENTION, OIL INDUSTRY, GUIDELINES, CANADA,
0873 WASTEWATERS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, DISPOSAL , BEAUFORT SEA, *DRILLING MUD,
0877 WASTEWATERS, SEDIMENTATION, RIVERS, NARRAGANSETT BAY, HYDROCARBONS , FATE, ESTUARIES, COASTS, *PROVIDENCE RIVER,
0897 WASTEWATERS, SEAWATER, PATENT, OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, BILGES, ADSORPTION,
0902 WASTEWATERS, PATENT, OIL-WATER SEPARATION, FILTRATION , DESIGN-ENGINEERING,
0907 WASTEWATERS, PATENT, OIL-WATER SEPARATION, ADSORPTION, *SORBENT GAUZE,
0909 WASTEWATERS, PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, EQUIPMENT, ADSORPTION,
0936 WASTEWATERS, USSR, RIVERS, POLLUTION CONTROL, PETROLEUM PRODUCTS, *URAL RIVER,
0975 WASTEWATERS, REFINERIES, PHYTOPLANKTON, INTERTIDAL ZONE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA,
1022 WASTEWATERS, SOURCES, RIVERS, CONTAMINANTS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES,
1076 WASTEWATERS, TOXICITY, MARINE ORGANISMS, FOOD WEB, BIODEGRADATION, ACTIVATED SLUDGE, YEASTS,
1172 WASTEWATERS, TOXICITY, REFINERIES, BIOASSAY, WATER QUALITY, *DAPHNIA,
R063 WASTEWATERS, SAMPLING, REFINERIES, ACTIVATED SLUDGE, *RESIDUALS, *PNA,
R064 WASTEWATERS, TOXICITY, SAMPLING, REFINERIES, CONTAMINANTS, ANALYTICAL TECHNIQUES,
R065 WASTEWATERS, TOXICITY, REFINERIES, INVERTEBRATES, INTERTIDAL ZONE, FRESHWATER, FISH, BIOASSAY, ANALYTICAL TECHNIQUES,
R081 WASTEWATERS, TOXICITY, PAH, HEALTH HAZARDS, CONTAMINANTS, ANIMALS,
R106 WASTEWATERS, REFINERIES, PACIFIC OCEAN, MOLLUSKS, CRUSTACEANS, BIOLOGICAL EFFECTS, BIOINDICATORS,
R149 WASTEWATERS, STATISTICAL ANALYSIS, REFINERIES, MODELS, GUIDELINES, EPA, COST ANALYSIS, API,
0825 WASTEWATER TREATMENT, STATISTICS, REFINERIES, EUROPE, WATER QUALITY,
0827 WASTEWATER TREATMENT, REFINERIES, OXIDATION, BIOLOGICAL TREATMENT, *AERATION,
0828 WASTEWATER TREATMENT, FLOTATION, EMULSIONS, *ELECTROFLOTATION,
0829 WASTEWATER TREATMENT, REFINERIES, RECYCLING, CONTAMINANTS,
0831 WASTEWATER TREATMENT, INDUSTRIES, *PROCEEDINGS,
0832 WASTEWATER TREATMENT, PH CONTROL, LUBRICATING OIL, EMULSIONS, COALESCENCE,
0833 WASTEWATER TREATMENT, PATENT, FLOCCULATION, EMULSIONS, ABSORPTION, *COAGULATION,
0834 WASTEWATER TREATMENT, LUBRICATING OIL, FLOTATION, EQUIPMENT, DESIGN-ENGINEERING,
0835 WASTEWATER TREATMENT, PATENT, EMULSIONS, COALESCENCE, *DETERGENT-OIL MIXTURES,
0836 WASTEWATER TREATMENT, PATENT, EMULSIONS, ADSORPTION,
0838 WASTEWATER TREATMENT, REFINERIES, FLOTATION, FILTRATION , *PILOT STUDY, *MICROSCREENING,
0841 WASTEWATER TREATMENT, ULTRAFILTRATION, OIL-WATER SEPARATION, *MEMBRANES,
0842 WASTEWATER TREATMENT, REFINING, PETROCHEMICALS, MANUALS, INDUSTRIES,
0844 WASTEWATER TREATMENT, REFINERIES, POLLUTION CONTROL, DESIGN-ENGINEERING, *TAIWAN,
0845 WASTEWATER TREATMENT, REFINERIES, PETROCHEMICALS, INDUSTRIES,
0846 WASTEWATER TREATMENT, SURFACTANTS, PATENT, *ELECTROLYSIS,
0847 WASTEWATER TREATMENT, REFINERIES, PH CONTROL, HYDROCARBONS , CONTAMINATION, *COAGULATION,
0848 WASTEWATER TREATMENT, PETROCHEMICALS, AROMATIC HYDROCARBONS, ADSORPTION, *ACTIVATED CARBON,
0849 WASTEWATER TREATMENT, SHIPS, PATENT, FLOTATION, *ELECTROLYSIS,
0852 WASTEWATER TREATMENT, SKIMMERS, PRODUCT INFORMATION,
0854 WASTEWATER TREATMENT, TANKERS, INDUSTRIES, BALLAST , *REVIEW,
0855 WASTEWATER TREATMENT, REUSE, REFINERIES, OXIDATION, CONSERVATION, *BIOOXIDATION,
0857 WASTEWATER TREATMENT, PATENT, OIL-WATER SEPARATION, COALESCENCE,

0858 WASTEWATER TREATMENT, PATENT, *ELECTROLYSIS,
0859 WASTEWATER TREATMENT, SLUDGE , PATENT, OIL-WATER SEPARATION, GRAVITY SEPARATION, FILTRATION ,
0860 WASTEWATER TREATMENT, USN, SKIMMERS, OIL TERMINALS, FLOTATION, *COAGULATION,
0861 WASTEWATER TREATMENT, PATENT, OIL-WATER SEPARATION, BILGES, *DECANTATION TANKS,
0862 WASTEWATER TREATMENT, WASTE OIL, WATER QUALITY, *MUNICIPAL SEWAGE,
0863 WASTEWATER TREATMENT, WASTE OIL, VIRGINIA, USN, TANKERS, OIL TERMINALS, DESIGN-ENGINEERING,
0864 WASTEWATER TREATMENT, RECYCLING, PATENT, FILTRATION ,
0865 WASTEWATER TREATMENT, PETROLEUM PRODUCTS, PATENT, EMULSIONS,
0866 WASTEWATER TREATMENT, ULTRAFILTRATION, OIL-WATER SEPARATION, INDUSTRIES, *POROUS GLASS MEMBRANE,
0867 WASTEWATER TREATMENT, SHIPS, OIL-WATER SEPARATION, INCINERATION, FLOTATION, FILTRATION
0868 WASTEWATER TREATMENT, SLUDGE , ADSORPTION, *SAND-OIL BINDER LAYER,
0869 WASTEWATER TREATMENT, PATENT, DESIGN-ENGINEERING, *FIBER AGGREGATES,
0870 WASTEWATER TREATMENT, SORBENTS, PETROLEUM PRODUCTS, *POLYURETHANE FOAM,
0875 WASTEWATER TREATMENT, PATENT, FLOTATION, FLOCCULATION, EMULSIONS,
0876 WASTEWATER TREATMENT, SAMPLING, OIL-WATER SEPARATION, HYDROCARBONS ,
0878 WASTEWATER TREATMENT, PAH, HYDROCARBONS , FLOCCULATION, CONTAMINANTS,
0879 WASTEWATER TREATMENT, SOLID WASTES, REFINERIES,
0883 WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, COALESCENCE, *FIBROUS BEDS,
0893 WASTEWATER TREATMENT, PATENT, OIL-WATER SEPARATION, FLOTATION, FLOCCULATION, FILTRATION ,
0932 WASTEWATER TREATMENT, US, REFINING, POLLUTION CONTROL, LEGISLATION,
1010 WASTEWATER TREATMENT, REFINERIES, RECOVERY, DISTRIBUTION, CHRONIC EFFECTS, BIOMASS, BENTHOS, *RECOLONIZATION,
1036 WASTEWATER TREATMENT, POLLUTION CONTROL, ANALYTICAL TECHNIQUES, *REVIEW,
1131 WASTEWATER TREATMENT, REFINERIES, LEGISLATION, EPA, *CLEAN WATER ACT 1977,
1159 WASTEWATER TREATMENT, SOLID WASTES, SAFETY, POLLUTION CONTROL, OCEANS, *REVIEW,
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1,012,071	C-0840
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77,127,489	C-0809
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75 07,281	C-0898
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448,755	C-0806
Swedish Patent	
396,064	C-0810
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Environmental Technology and Economics
EPA Reports Bibliography Quarterly
ERDA Energy Research Abstracts
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Government Reports Announcements
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International Journal of Environmental Analytical Chemistry
International Journal of Environmental Studies
International Petroleum Abstracts
Iranian Journal of Science and Technology
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Journal of Chromatography
Journal of Environmental Science and Health, Part A
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Journal of the Institute of Water Pollution Control
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
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Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Microbial Ecology
National Fisherman
National Research Council, News Report
National Wildlife

Nature
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Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of Scientific Fisheries
Ocean Engineering
Ocean Industry
Ocean Management
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Oceanus
Offshore
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
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Resources
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Science
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UDS Water Quality Control Digest
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Waste Materials Biodegradation Research Titles
Water, Air and Soil Pollution
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